Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

NOV 22 1954
DETROIT

m and i

THE MICANITE & INSULATORS CO. LTD. EMPIRE WORKS, BLACKHORSE LANE, WALTHAMSTOW, LONDON. E.17.

Erinoid

Plastics Materials

used in the manufacture of high grade

ELECTRICAL ACCESSORIES

ERINOID LIMITED · STROUD · GLOUCESTERSHIRE

Durawires • Duracables

P.V.C. Insulated

Insulation accurately extruded to ensure concentricity

In addition to our wide range of P.V.C. Insulated standard wires and cables, we specialise in the design and manufacture of cables for exceptional requirements.

Durastrip

In a variety of artistic colours and novel designs for ladies' and gentlemen's belts, etc.

Also available in two-colour direct extrusions (not colour printed) and in clear, transparent material.

Sole Manufacturers:

Duratube & Wire Ltd.

FELTHAM **MIDDLESEX**

Telephones: Feltham 3453-6

Resinous Chemicals Limited

RCL

invite enquiries for

SYNTHETIC RESINS

suitable for the manufacture of

MOULDING POWDERS

Enquiries to

RESINOUS CHEMICALS LIMITED
Blaydon, County Durham

Varnish media · Synthetic Resins & Glues
Moulding powders · Fine Colours · Chemicals

PHONE: BLAYDON 347-8

GRAMS: RESCHEM, BLAYDON-ON-TYNE

R1

Holing out in hundreds

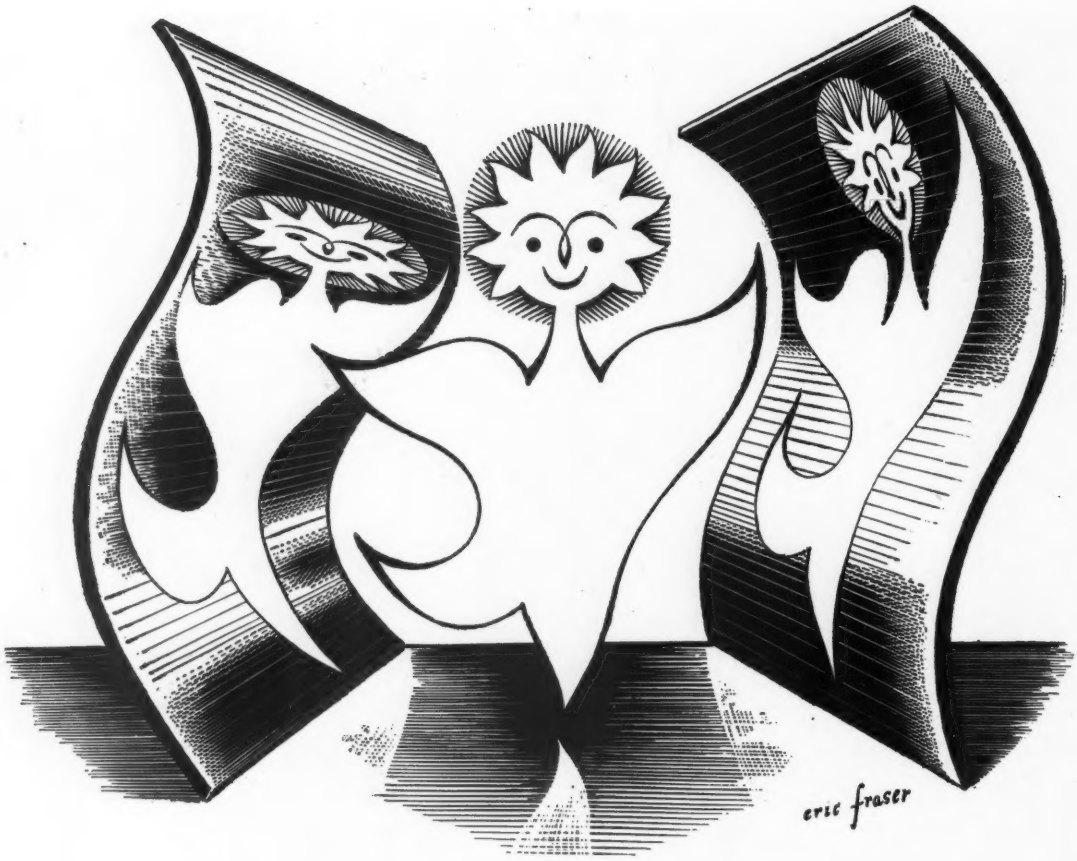
In an earlier announcement, we showed the blanks, hobs and hobbings used in button mould production. Here, now, is the machine which bores holes in the chase plates which carry the dies. Up to two or three hundred holes may be needed in plates for button, tube cap or similar moulds. This machine bores them quickly with accurate centring and exact alignment. Why do we illustrate this machine? Not because it is elaborate, large or expensive, although in fact it is all these things. Rather, as an example of our equipment policy — to find and install plant which combines precision with high output, enabling us to produce at economical prices the highest quality moulding tools available.

B.I.P. TOOLS LIMITED

(Member of The Gauge & Tool Makers' Association) TYBURN ROAD, ERDINGTON, BIRMINGHAM 24

Telephone: Birmingham East 2061 · Telegrams: Plasmould Birmingham 24

B·I·P GROUP



'FLEXIBLE' IS MY MIDDLE NAME! *says Mr. Therm*

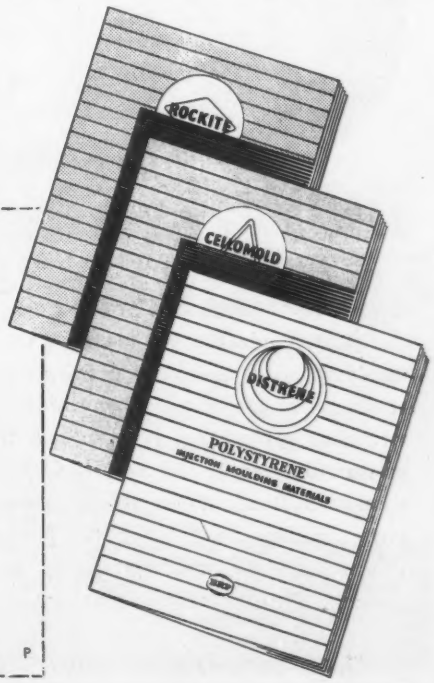
The gas and gas-heated equipment that Mr. Therm brings in his train are amazingly flexible in their applications to all sorts of heating problems. What other fuel but gas could give you a tiny—but steady—pin-point of flame or full heat the instant you want it? And gas can be controlled at the flick of a finger—or can be completely automatic if required. It needs no storage space, is smokeless and ash-free, and works unfailingly for you with remarkable efficiency. No wonder Mr. Therm is to be found hard at work in so many industries!

In particular, the plastics industry has many reasons to be thankful for Mr. Therm's skilled assistance, and one reason is shown in the accompanying photograph. This compact layout of high pressure gas connections, at the works of Messrs. A. F. Bulgin & Co. Ltd., Barking, takes complete care, with its own thermostatic controls, of the heating of platens for moulding parts of electric switches. In a restricted layout such as this, gas provides the perfect answer to many of the plastics industry's heating problems.

MR. THERM BURNS TO SERVE YOU! THE GAS COUNCIL · 1 GROSVENOR PLACE · LONDON · SW1

WHETHER YOU ARE INTERESTED AT THE MOMENT, OR NOT,

IN ROCKITE PHENOLIC AND UREA MOULDING POWDERS, IN CELLOMOLD CELLULOSE ACETATE INJECTION MOULDING MATERIALS, OR IN DISTRENE POLYSTYRENE INJECTION MOULDING MATERIALS, WE FEEL THAT YOU SHOULD HAVE AT HAND THIS SET OF THREE BOOKLETS DESCRIBING THE USE AND APPLICATION OF THESE PLASTICS THAT HAVE BECOME ESTABLISHED IN PRACTICE AS THE MOST VERSATILE OF THEIR KIND. PLEASE COMPLETE AND DISPATCH THE COUPON BELOW



To: **BRITISH RESIN PRODUCTS LIMITED**
Sales and Technical Service,
21 St. James's Square, London, S.W.1.

Please send me a set of the three booklets describing Rockite, Cellomold and Distrene Moulding Materials.

NAME .....

COMPANY .....

ADDRESS .....

.....

P

"Rockite", "Cellomold" and "Distrene" are Regd. Trade Marks

BRP

TURNER *self-contained* PLASTICS PRESSES

The only Press with all these advantages

SELF-CONTAINED : Fitted with a sealed unit hydraulic system which incorporates a compact and efficient high-pressure pump.

VARIABLE PRESSURE : By means of a handwheel on the pump, pressure can be adjusted between the maximum and minimum force specified for each type of press.

SEALED HYDRAULICS : The hydraulic system is wholly contained in a sealed oil tank, and foreign matter is thus completely excluded.

SIMPLICITY OF CONTROL : A single lever controls both upward and downward movements of the ram.

SIMPLE TO INSTALL : To install the press it is only necessary to make one connection to the electric supply.

EASY TO MAINTAIN.

SAFETY IN OPERATION: Mechanically interlocked safety guards prevent the ram being moved unless guards are completely closed. Electrical switchgear and controls totally enclosed.

Entirely new in design and principle of operation, Turner Plastics Presses represent the greatest advance yet made in the production of presses for compression moulding of plastics, deep drawing and other pressing operations. Each press combines the uses of many by providing a range of variable pressures. The larger type gives any required pressure between 25 and 125 tons, the smaller model any pressure between 10 and 50 tons. They are fully self-contained and incorporate a unique hydraulic system which is completely sealed against dust and dirt, but is easily accessible for inspection and maintenance. Compact in construction, Turner Presses enable the greatest productive use to be made of every foot of factory floor space. Fully descriptive literature gladly sent on request.

TURNER MANUFACTURING COMPANY LIMITED, VILLIERS STREET, WOLVERHAMPTON

We are not making bullets . . .

. . . for the Defence Programme. But we are producing injection mouldings for many of the allied industries—Radar, Radio, Electrical, Automobile, Aeronautical, Marine, etc., etc. (some recent productions are shown here).

We are specialists in technical mouldings up to 16 ozs. in the usual thermo-plastic materials.

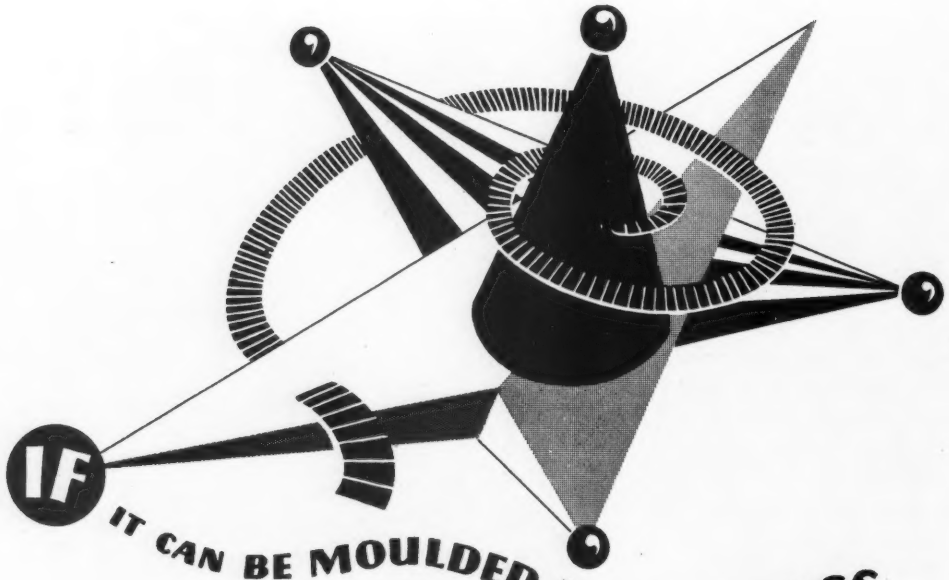
Our planning Department, Technical and Advisory Staff are at your service.

INJECTION MOULDERS *Ltd.*

WESTMORELAND ROAD, LONDON, N.W.9

Telephone: COLindale 8868/9, 8860
Grams: Injecmould, Hyde, London

IM 14



WE CAN DO IT . . .

and in the RIGHT material

Why not let us relieve you of all trouble and responsibility for your job, completely from the beginning to the end.

THE PLASTOMATIC SERVICE—

(1) Moulds and delivers at the stipulated times any quantities of any article already designed and tooled.

(2) Undertakes design and tooling which conform to the mechanical principles that ensure the very finest results in plastics.

(3) Guarantees that the right material will be used.

(4) Means the customer's exclusive right under contract to any Plastomatic design approved and used.

LET US QUOTE YOU FOR YOUR JOB

Optically Correct Lenses Electrical and General Engineering Components Projectors
Photographic Appliances Tap and Valve Washers Car Accessories Fancy Goods
Games, Toys, etc.

PLASTOMATIC LTD

Registered 641,685 Trade Mark

MOULDERS OF PLASTIC MATERIALS TO THE TRADE

Members of The British Plastics Federation and on the official list of Contractors to H.M. Government.

17, WINCHESTER ROAD, HAMPSTEAD, LONDON, N.W.3 *Telephone : PRIMROSE 4463*

PL.2

CHLOROFORM

CH 3071 D

ETHER

IN ALL PROCESSES REQUIRING A B.P. GRADE OF CHLOROFORM OR A B.P. OR B.S.S. 579 GRADE OF ETHER SOLVENT THE M&B PRODUCTS MAY BE RELIED ON FOR CONSISTENTLY SATISFACTORY RESULTS

Enquiries to **MAY & BAKER LTD DAGENHAM**

TELEPHONE: ILFORD 3060 EXTENSION 219

B

"I said we could form a better cabinet ourselves, Mr. Ash!"

"We could indeed, Mr. Downs."

"*I told the fella' that for twenty years customers have been bringing us their ideas*—"

"Portfolios full of 'em—you might say, Mr. Downs."

"*Exactly, and we've got the know how, and the capacity to make deeper and larger moulded cabinets than most manufacturers believe possible—and we always like to tackle something on a big scale, Mr. Ash!*"

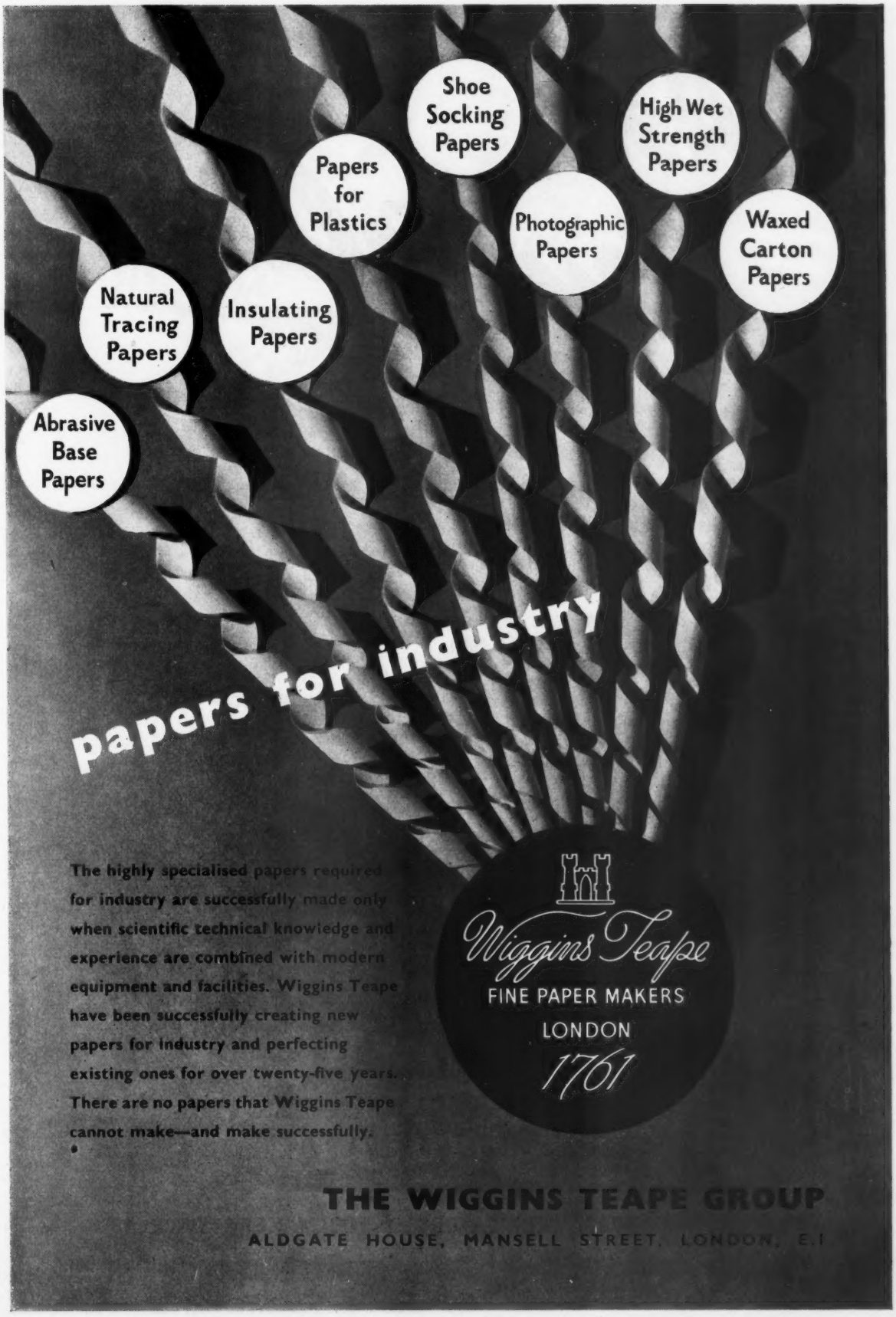
"We do, indeed, Mr. Downs."

"*So I said*

If you want to know what plastics can do for you—

ask Ashdowns

ASHDOWNS LTD., Eccleston Works, St. Helens, Lancs. Phone: St. Helens 3206 *Ashdowns Ltd. is a subsidiary of Pilkington Brothers Ltd*


Shoe Socking Papers
High Wet Strength Papers
Papers for Plastics
Photographic Papers
Waxed Carton Papers
Natural Tracing Papers
Insulating Papers
Abrasive Base Papers
papers for industry
The highly specialised papers required for industry are successfully made only when scientific technical knowledge and experience are combined with modern equipment and facilities. Wiggins Teape have been successfully creating new papers for industry and perfecting existing ones for over twenty-five years. There are no papers that Wiggins Teape cannot make—and make successfully.
Wiggins Teape
FINE PAPER MAKERS
LONDON
1761
THE WIGGINS TEAPE GROUP
ALDGATE HOUSE, MANSELL STREET, LONDON, E.1

Ask Crystalate to quote for Your job in Moulded Plastics

CRYSTALATE

PLASTIC MOULDERS, FABRICATORS & TOOLMAKERS SINCE 1899

Crystalate Ltd., Crystalate House, Mill Lane, Tonbridge, Kent. *Phone : Tonbridge 2261/2/3/4/5.*

Mouldersand Fabricators of ALL Plastic Materials

FROM the smallest to the largest and most complicated plastic component for Aircraft and other industries, we, as the actual manufacturers, are entrusted with the work of many famous firms who demand accuracy and quality, first and always.

Our highly qualified technical staff is at your service.

THERMO - PLASTICS LTD

DUNSTABLE — BEDS

Telephone: DUNSTABLE 686/7/8 and 777 *Telegrams:* THERMOPLASTICS, DUNSTABLE

Aircraft Components · Refrigerator Accessories · Sanitary and Bathroom Fittings
Radio and Television Components · Motor Car and Caravan Accessories
Canteen and Catering Equipment · Instrument Cases · Travel Goods
Batteries and Accumulators · Signs · Advertising Display · Shop Fittings

TP DUNSTABLE

POLYVINYL CHLORIDE?

OR

"PERSPEX"?

Any old polystyrene, P.V.C., "perspex" scrap and offcuts?

We're particularly interested in buying these, and

all other kinds of thermoplastic scrap and surplus material,

and we give the best possible prices.

Let us know the kinds and quantities you have for disposal.

BERNARD CHASE

Sole agents in Great Britain, France and Spain for H. Muehlstein & Co. Inc., New York.

6-8, CRUTCHED FRIARS, LONDON, E.C.3

Tel: ROYal 7654 *(6 lines)* *'Grams: Mulbright, London*

A complete range of

Polyvinyl Chloride

PRODUCTS

● **VINATEX P.V.C. COMPOUND**
FOR EXTRUSION including sheathing (dielectric and arctic grades), belting and piping.
FOR CALENDERING
FOR INJECTION MOULDING

● **VINATEX P.V.C. PASTE**
FOR LEATHERCLOTH coated paper and casting. Special grades for low temperature flexibility and non-tacky finishes. Supplied pigmented or clear.

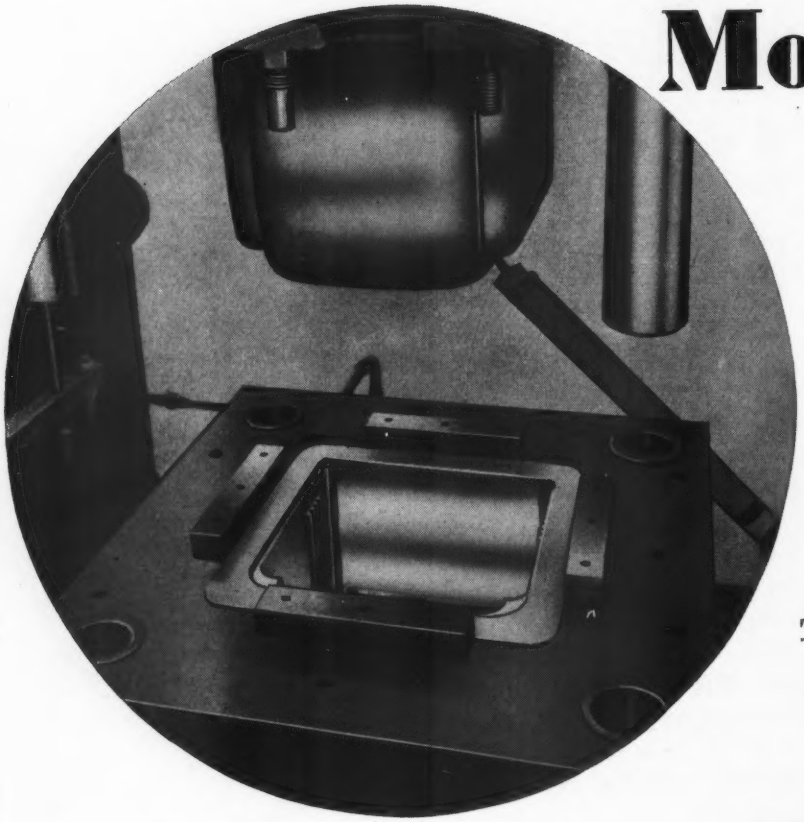
● **VINATEX P.V.C. SHEETING and LEATHERCLOTH**
P.V.C. FLEXIBLE SHEETING and Leathercloth including press polished sheets, calendered plain or printed sheeting in all colours. Embossed supported and unsupported sheet in single or two colour effects.

VINATEX LIMITED
DEVONSHIRE ROAD · CARSHALTON · SURREY
(Wallington 5333)

VINATEX LIMITED IS A UNIT OF VINYL PRODUCTS LIMITED

VP 26b

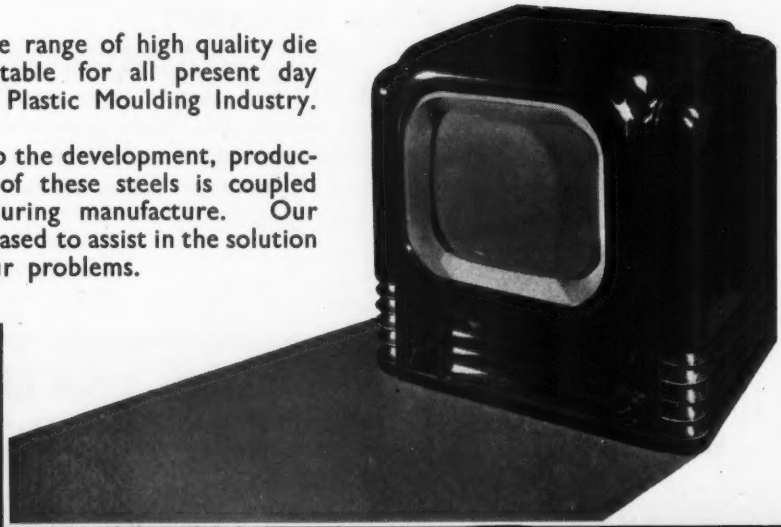
DIE STEELS for Plastic Moulding



The photographs show the mould and a Bush Television cabinet manufactured by British Moulded Plastics, Ltd. The Dies are made from PLMB/I Steel manufactured by English Steel Corporation Ltd.

E.S.C. produce a wide range of high quality die steels, eminently suitable for all present day requirements of the Plastic Moulding Industry.

Constant research into the development, production and application of these steels is coupled with rigid control during manufacture. Our technicians will be pleased to assist in the solution of your problems.



ESC

ENGLISH STEEL CORPORATION LTD

OPENSHAW MANCHESTER

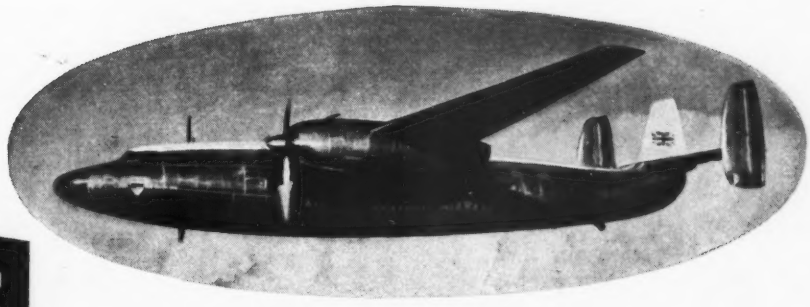


Photo reproduced by courtesy of Airspeed Ltd.

FORMICA REGD.

chosen for the "Elizabethan"

For the new "Elizabethan" class Airspeed Ambassador aircraft shortly to be operated by B.E.A. on European routes, the table tops are surfaced in pink linette FORMICA. This extremely practical laminated plastic considerably enhances the bright, friendly atmosphere of the new aircraft's decorative scheme.

Photo reproduced by courtesy of Airspeed Ltd.

FORMICA is

HARD-WEARING — It resists alcohol, acids, alkalies, spilt foods and constant rubbing. Articles can be dropped on Formica — yet the surface will not crack or craze. Kicking and scuffing cannot mar it.

HYGIENIC — Its hard, smooth surface is completely non-porous and cannot harbour germs.

LIGHT IN WEIGHT — Formica is only half the weight of aluminium.

HEAT RESISTING — Temperatures up to 120° C. cannot affect Formica — and, with the Cigarette-Proof grade, table tops cannot be damaged by burning cigarette ends. Formica will not support combustion.

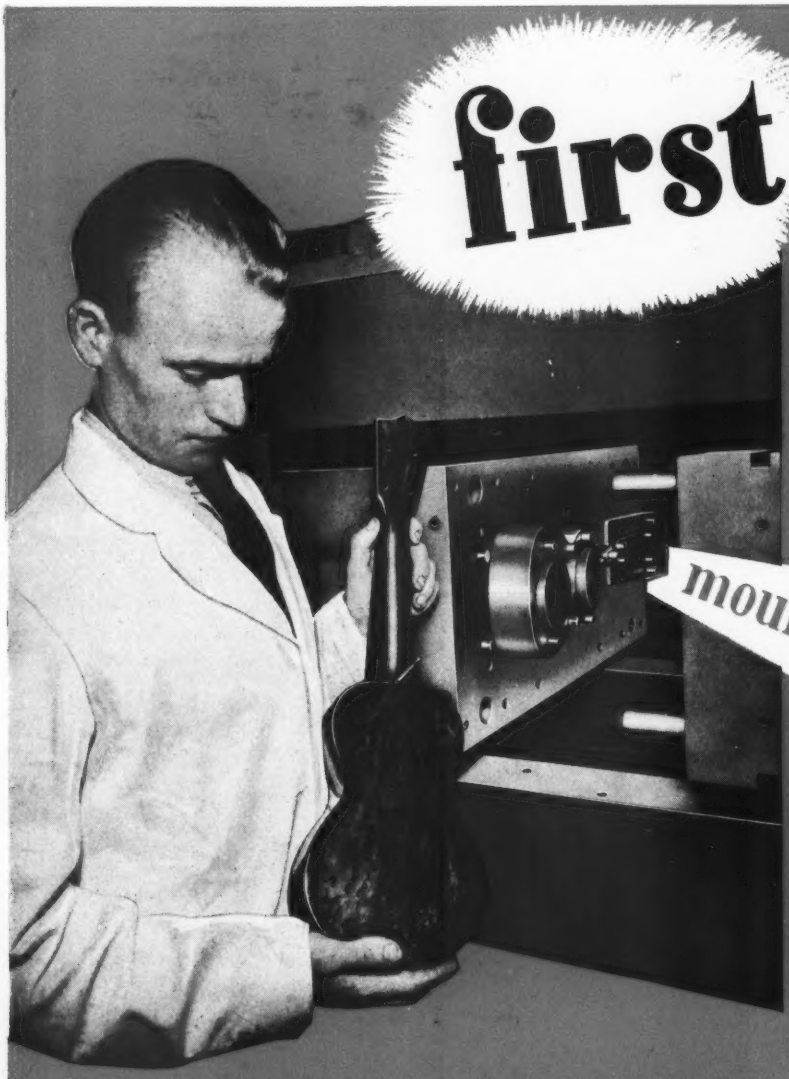
PERMANENT — Once installed, Formica never needs renovation nor renewal. A wipe with a damp cloth keeps it bright and clean. Colours and designs are fadeproof — cannot wear away.

For full information about FORMICA, please write to:—

THOMAS DE LA RUE & CO. LTD. (PLASTICS DIVISION), IMPERIAL HOUSE, 84/86 REGENT STREET, LONDON, W.1

'FORMICA' is a registered trade mark and De La Rue are the sole registered users.

C



first

STRING

60 SHOTS P

WEIGHT 6¾ oz.

moulded on a 'PECO

Mould Manufactured by Universal Tools Ltd.

THE PROJECTILE & ENGINEERING COMPANY specialise in the manufacture of injection moulding machines and produce a range in 2, 4, 6, 8 and 16 oz. capacities. They are self-contained with automatic cycle and are hydraulically operated. They have a high plasticising capacity and rate of injection. Mould-locking pressure and platen area enable them to operate at a high rate of production.

MOULDS

PECO MOULDS. Expert designers and mould makers are employed and moulds can be supplied to samples submitted, including die-sinking models if required. An important side of the company's work is the hobbing of cavities for moulds and medallions—the plant includes a 3,000 ton hobbing plant. Master hobs to customers' samples made as required.

Full particulars of the **PECO** *range of injection moulding machines and moulds will be sent on request.*

PECO PROJECTILE PRODUCTS

The PROJECTILE & ENG

ACRE STREET · BATTE

Telephone: Macaulay 1212 Telegrams: "Profe

...ED INSTRUMENT ...JECTION-MOULDED

IN GREAT BRITAIN AND EUROPE

...S PER HOUR

...GTH 20¼" WIDTH 6¼"
...H 2¼"

This genuine musical instrument moulded on a **PECO** 8 oz. capacity machine by the **THAMES VALLEY MOULDERS** incorporates all the features of the best hand-made ukulele at a fraction of the cost. It is being distributed by **SELCOL PRODUCTS LTD.** In precision instruments of this type, where extreme accuracy has to be maintained, it is essential for temperature control to be maintained at a close tolerance to give the stability required.

...03. machine

...EERING COMPANY Ltd.
...EA · LONDON · S.W.8
...Profec...Cloproad, London" Cables: Profectus, London

The secret of phenoltriumviratebullitricyllicate revealed at last!

"REVOLUTIONARY MATERIAL READY WITHIN TWO YEARS" *says Professor Oinsk*

from our East Anglian Correspondent.

Rudolph Oinsk has devoted his life to plastics. "Why! When I was knee-high to a Bunsen burner," he explains in his attractive Mid-Western brogue, "I used to ask Mom to take me to the plastic-works to see the bodies of scientists who have passed beyond."

Professor Rudolph Oinsk

Such early signs of scientific devotion were soon to bud and flower. Few will have forgotten Oinsk's early work on molecular transmutation or his discovery of Stronk.

Now, in early middle age, comes his greatest triumph, 'Mostannoid.' In the Professor's own words: "You can heat 'Mostannoid,' you can treat it, bend it, work it without a trace of manactical mollification or fump!"

The Professor estimates that it will take two years to put 'Mostannoid' onto the commercial market. What is two years to such a young industry? For such obvious advantages our Grandfathers would have willed away a generation! It is perhaps too early to couple Oinsk with illustrious names like Smith and Jones, but it is the considered opinion of your reporter that 'Mostannoid' will make possible the fruition of so many of our dreams. Think of it! Within measurable time we shall be cleaning our teeth with 'Mostannoid' bristles and carting in 'Mostannoid' carts. Think of the debt we owe to Oinsk!

A section of Mostannoid after boiling in linseed oil. (Note the complete absence of spingling).

A WARNING.

Professor Oinsk has asked us to make it quite clear that 'Mostannoid,' despite its virtues, can in no way be expected to take the place of EAP Cellulose Acetate.

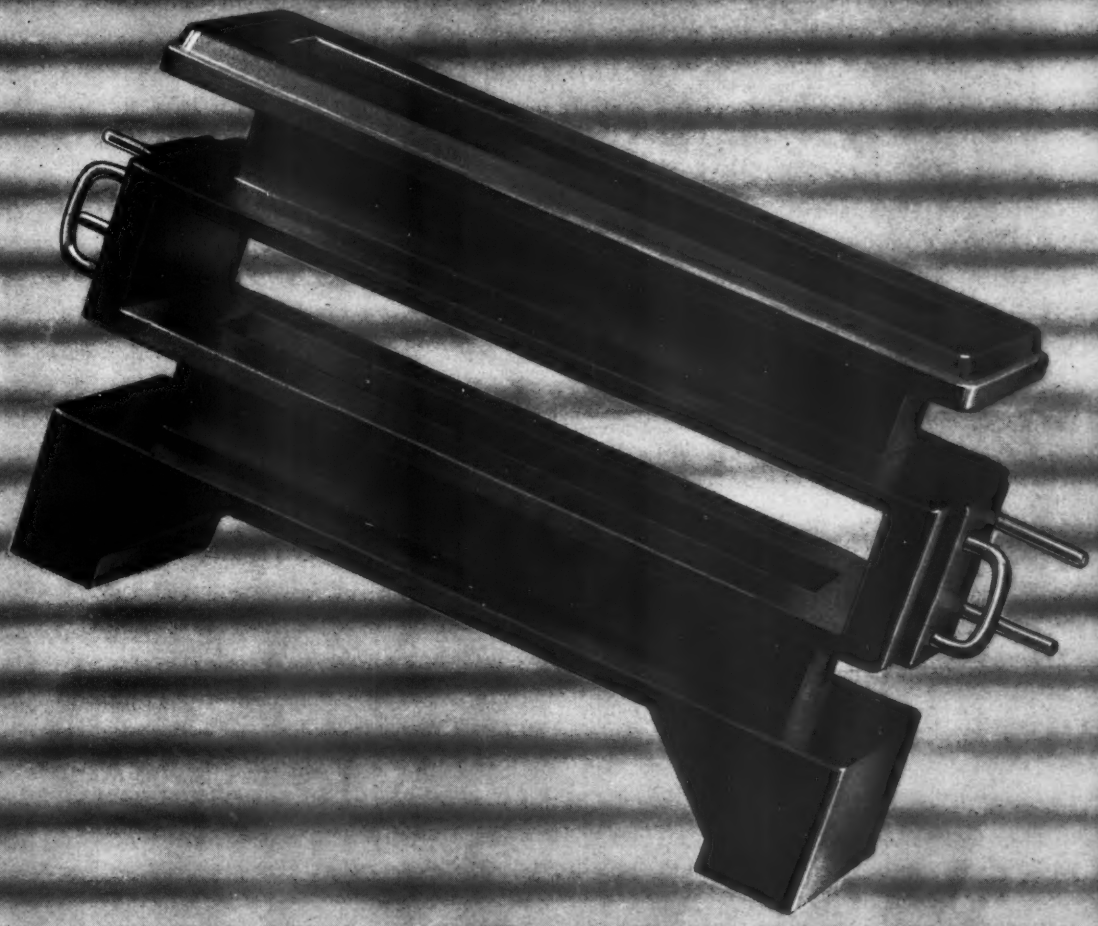
An early photograph of the great Jones.

Professor Oinsk's dog, "Bonky."

Although entirely unconnected with East Anglia Plastics Ltd., he is of the opinion that EAP Cellulose Acetate is incomparable in quality and versatility. It is a scientific boon that we can all benefit from right now. Come on, then, benefit!

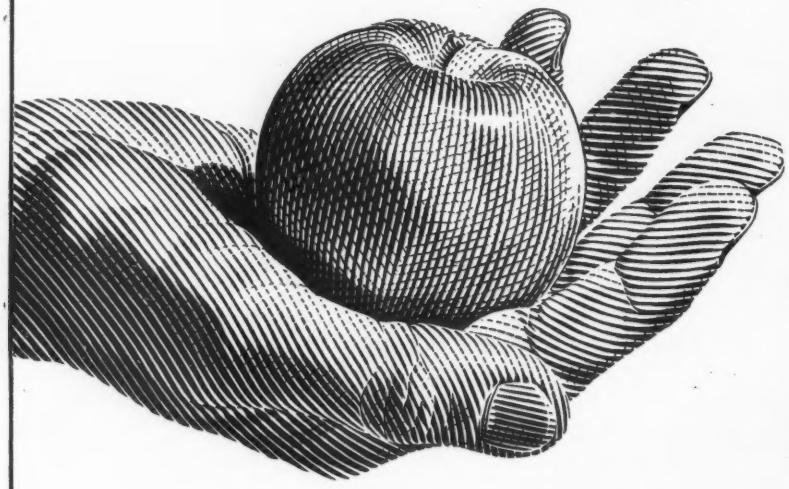
East Anglia Plastics Ltd.

52, Brook Street, Mayfair, W.1



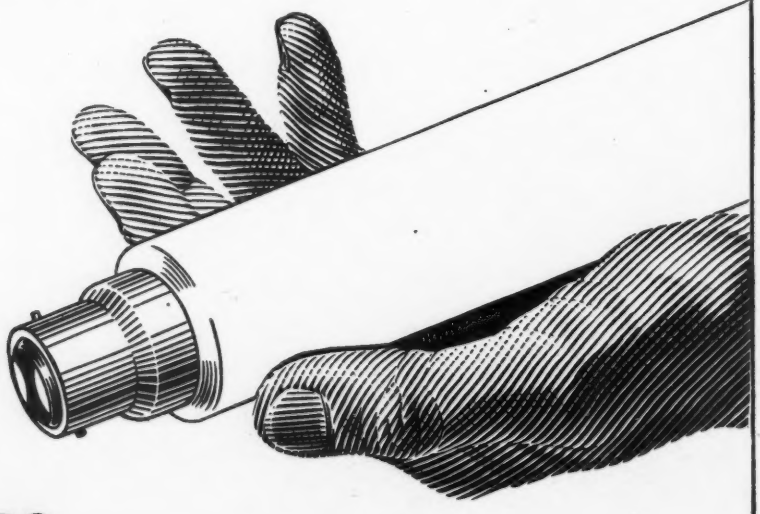
PLASTICS
ELO
PRODUCTS

BIRKBYS LTD. LIVERSEDGE YORKSHIRE
London Office :- 79 Baker Street W.1.



Pick of the bunch

All makes of fluorescent lamps look 'much of a muchness,' but eventually you will come to know the advantage of installing Osram. Good workmanship and vast technical knowledge — both in research and manufacture — contribute to the excellence of the finished article.

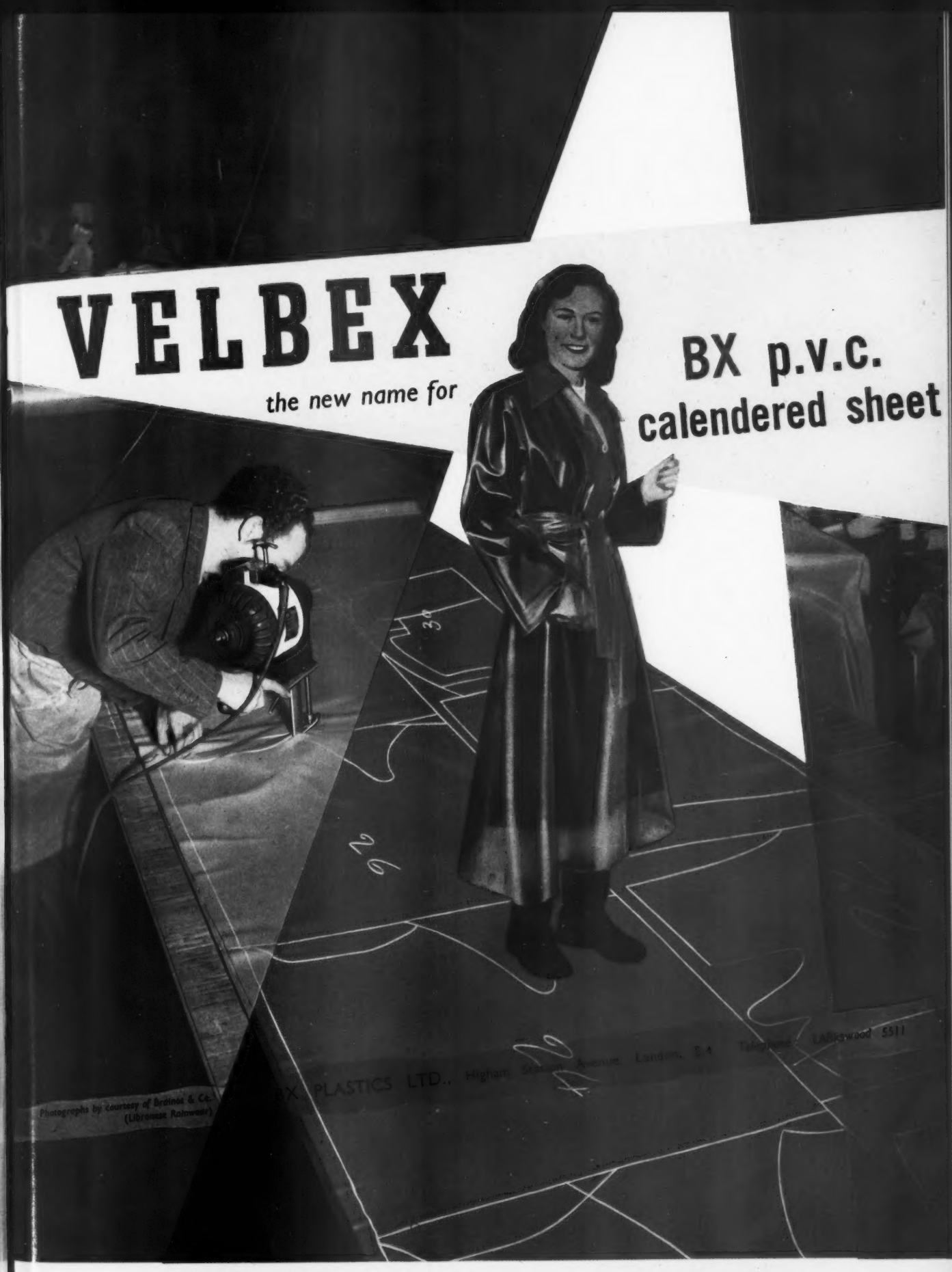


Osram *the wonderful lamp*

FLUORESCENT

A G.E.C. PRODUCT

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2



SHOWROOMS AND OFFICES: 6 Hanover Square, London, W.1 - - - - - - - - - Telephone: Mayfair 3614
King Street Buildings, 1 Ridgefield, Manchester 2 - - - - - - - - - Telephone: Manchester Blackfriars 0258
Empire House, 159 Great Charles Street, Birmingham 3 - - - - - - - - - - - - Telephone: Central 2365
OFFICE: 42 Wellington Street, Sheffield - Telephone: Sheffield 25517

This is the Lustrex building in the new Monsanto works at Newport, Mon. It is a special purpose plant based on Monsanto's long experience as producers of polystyrene and designed for bulk production of this important material.

The plant came into operation, as scheduled, in September, 1950. Thus, for the first time British-made polystyrene was available in bulk in a wide range of colours.

Lustrex maintains the high quality associated with all Monsanto products and availability will improve when raw material resources are developed, but this must needs take time. This will enable British designers to further their ideas in exploiting this versatile plastic.

Lustrex *the registered trade name for Monsanto's*

POLYSTYRENE MOULDING CRYSTALS

★ MON

CHEMICALS FOR
EVERY INDUSTRY
throughout the world

MONSANTO
CHEMICALS — PLASTICS

MONSANTO CHEMICALS LIMITED · Victoria Station House · London · S.W.1

High Quality P.V.C. Sheeting

"FABLON" Sheeting is made to exceptionally high standards of finish, durability and quality of production. It has a wide range of applications for domestic and household purposes, for wearing apparel; for hospital and industrial uses. Information, advice and samples on request.

Available in full standard range of attractive colours.

Thicknesses: of ·004" and above.
Widths: 48" & 54" standard, other widths to order.
Lengths: Rolls 150 yards. 100 yards to order.

Individual requirements and special formulations made to order.

C★P

COMMERCIAL PLASTICS LIMITED

1-9 HILLS PLACE, OXFORD STREET, LONDON, W.1

Works: Willington Quay, Wallsend-on-Tyne, Northumberland

Plastic Mouldings?

Enquiry

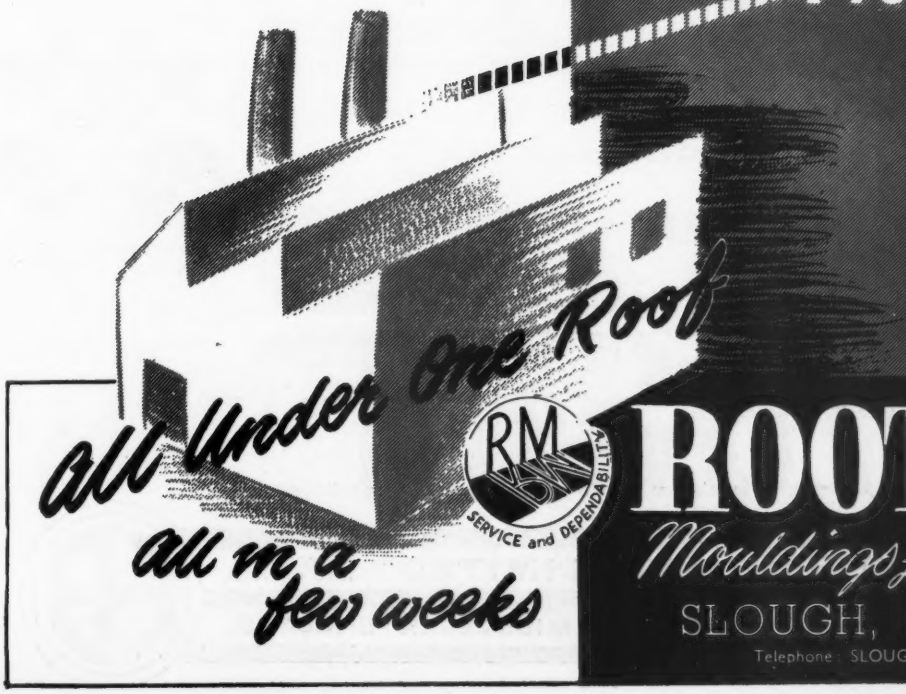
Quote

Order

Tools

Approval of Samples

Production



All Under One Roof

all in a few weeks

RM SERVICE and DEPENDABILITY

ROOTES

Mouldings Limited

SLOUGH, BUCKS

Telephone: SLOUGH 22349

HUPFIELD Plastics

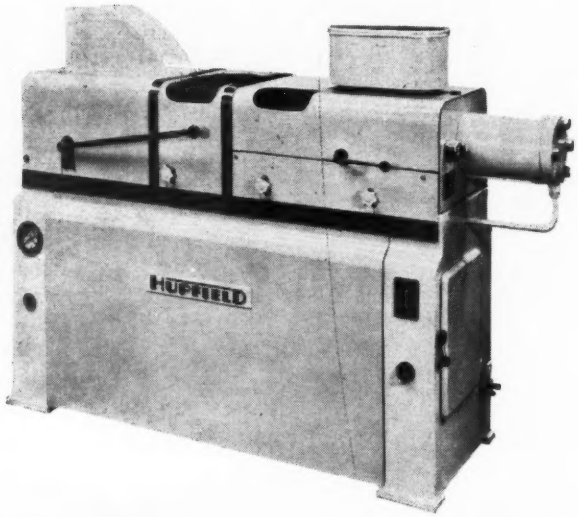
INJECTION MOULDING MACHINES

1 & 2 OUNCE CAPACITY

1951 MODELS

Single lever operated, semi-automatic, hydraulic machine, completely self-contained with electric motor. Fitted with a compensating feed mechanism and the latest Tem-Con automatic temperature control. The machine is economical to run and extremely simple to operate, ideal for female labour. All parts are standardised.

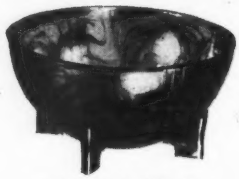
	1 oz.	2 oz.
Mould area approximately..	12 sq. in.	22 sq. in.
Plasticizing capacity per hour	9 lb.	18 lb.
Injection pressure	5½ tons	11 tons
Mould locking pressure ..	22 tons	44 tons
Shots per hour, subject to mould design	350	250



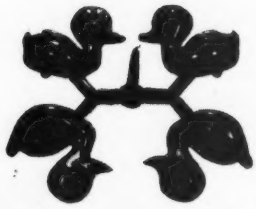
GRANULATING MACHINES

Granulates all thermoplastic materials, delivers at the rate of 80 lb. per hour. Cutting blades are adjustable and easy to clean. Completely self-contained with 2 h.p. electric motor.

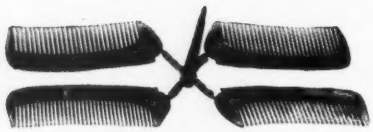
Mouldings from our 1 ounce machine.



polystyrene 3¾" dia.
25 seconds. 1 ounce.



cellulose acetate 5½" × 5"
30 seconds. 31 gramme.



polystyrene 8" × 3½"
20 seconds. 24 gramme.

Write for particulars, or telephone our Works (Wordsworth 4488) for a demonstration.

HUPFIELD BROTHERS LIMITED WORKS AND OFFICES

DALSTON GARDENS · STANMORE · MIDDLESEX · ENGLAND

FOR THOSE CONCERNED WITH DEFENCE CONTRACTS

AN UNRIVALLED SERVICE FOR THE SOLUTION OF ANY MOULDING PROBLEM

Many managements are faced with revised programmes brought about by the demands of recent defence measures. For contracts requiring the supply of high quality, high precision injection or compression mouldings, Ekco Plastics, suppliers to the Admiralty and Ministry of Supply, are ready for immediate action.

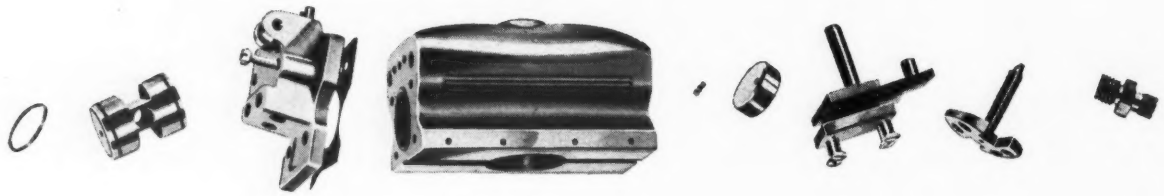
Ekco Plastics also relieve you of the responsibilities of Government test and inspection; their inspection staff are officially approved by A.I.D, Admiralty and all other Government Departments.

CONSULT EKCO PLASTICS

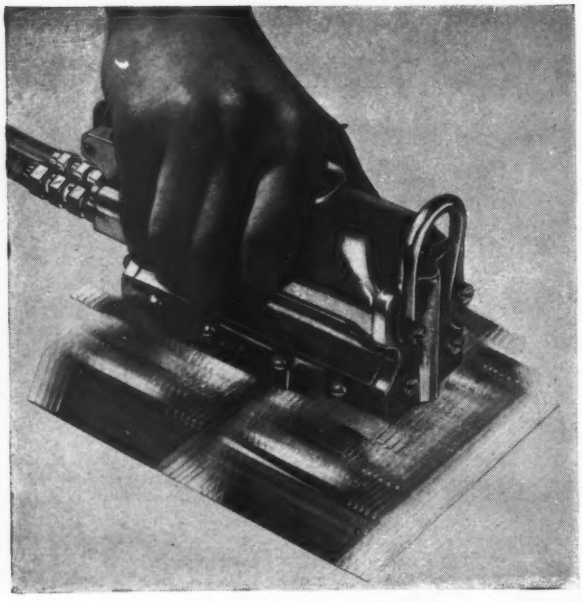
Members of the British Plastics Federation and the Society of the Plastics Industries of America.

E · K · COLE LTD. *(Plastics Division)* SOUTHEND-ON-SEA

THERE ARE 50 REASONS WHY



THE *Sundstrand* IS BETTER



There are over 50 precision parts in the Sundstrand Sander—that is why it is the finest sander available in the Country today—that is why it costs a little more than other sanders.

For sheer performance compare it point by point *with any other sander in the world.* It will save your costs in the long run.

The Sundstrand Sander operates at 2500-3500 oscillations per minute—on air pressures from 65-80 p.s.i.

For wet or dry sanding it will do the job better and faster than any other method. That is why they are used by many of the leading motor, aircraft and furniture manufacturers.

Write or 'phone for a demonstration.

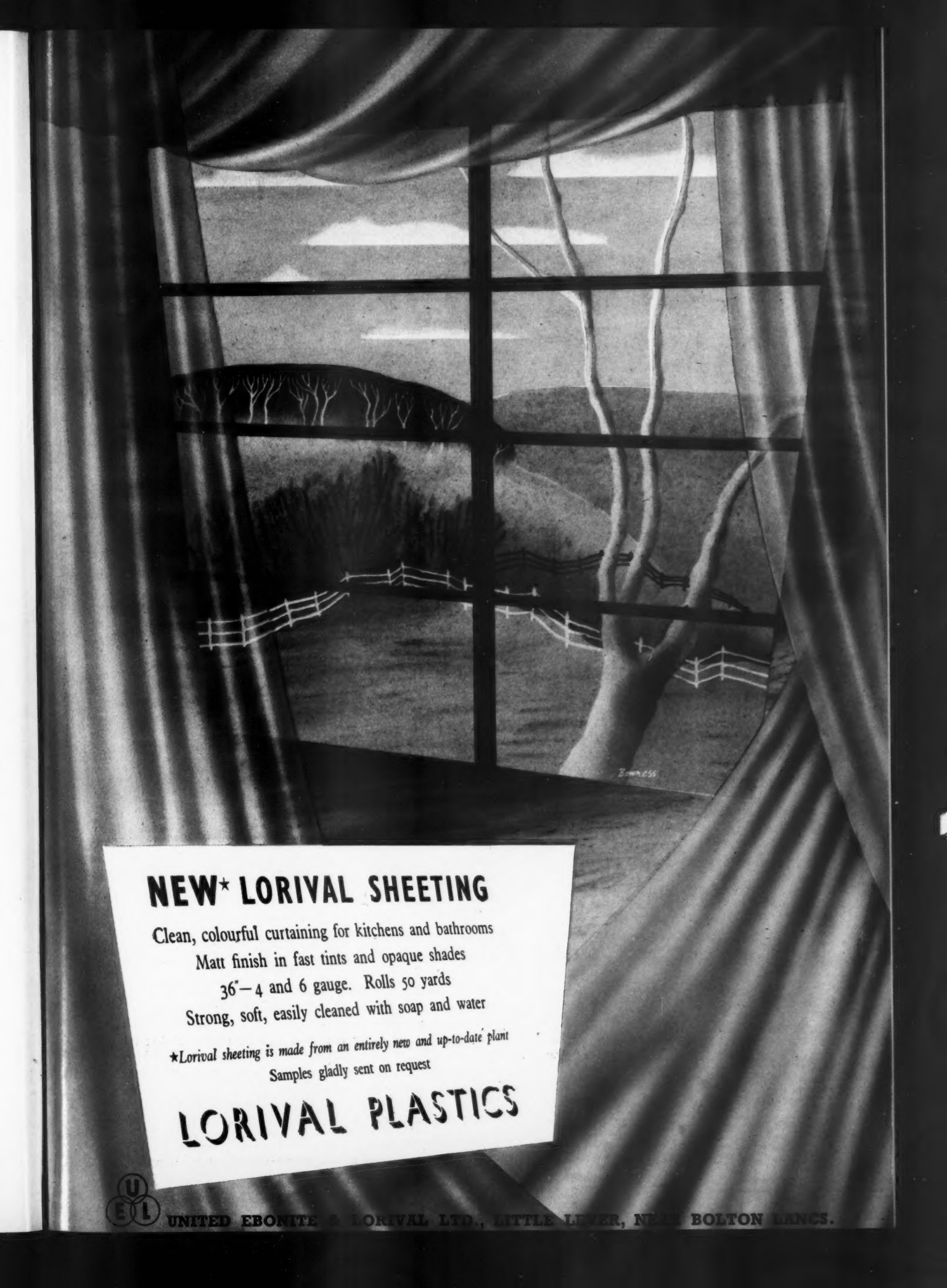
Sundstrand PNEUMATIC SANDER

SUNDSTRAND SANDERS LIMITED

NORGREN WORKS, SHIPSTON-ON-STOUR, WARWICKSHIRE. *London Office:* KENT HOUSE, 87 REGENT STREET, LONDON, W.1

Telephone: 106 and 110 *Telephone: REGent 2951*

M-W. 151



NEW* LORIVAL SHEETING

Clean, colourful curtaining for kitchens and bathrooms

Matt finish in fast tints and opaque shades

36"—4 and 6 gauge. Rolls 50 yards

Strong, soft, easily cleaned with soap and water

Lorival sheeting is made from an entirely new and up-to-date plant

Samples gladly sent on request

LORIVAL PLASTICS

UNITED EBONITE & LORIVAL LTD., LITTLE LEVER, NEAR BOLTON LANCS.

* FlexiGrip

The only Fastener with THESE advantages....

All plastic and supplied in continuous length on rolls—by the mile if required !

Any length can be cut off as desired—stock problems eliminated !

Can be sewn or WELDED to plastic items—a better joint, a better job, a bigger profit !

Double-engaging, snag-proof construction replaces messy looking teeth and gives AIR and WATER-TIGHT closure.

A complete colour match for every job.

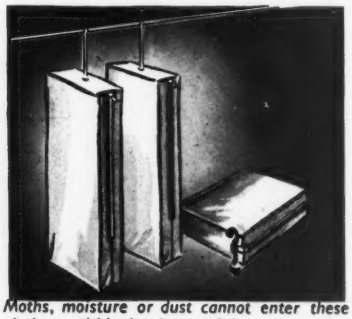
Will withstand a lateral strain of up to 35 lbs. pressure per inch.

The perfect closure for many previously unsolved PACKAGING problems !

* *Registered Trademark and name— World Patents issued and pending*

A cosmetic kit and beach-bag fitted with FLEXIGRIP. *Water-proof—snag-proof—sand-proof—eye-appealing !*

The fastener on this cycle cape will not jam, leak or get rusty—It's FLEXIGRIP!



Moths, moisture or dust cannot enter these clothes and blanket bags. Ask your supplier to investigate the use of FLEXIGRIP *in their products.*

The Miracle PLASTIC Fastener

The story is simple but amazing. FLEXIGRIP is the all plastic, snag-proof, toothless zipper specifically designed for use in articles made of flexible, plastic film. It comes on long rolls in any colour you want, ready to be snipped to length and installed in a simple operation.... by the same welding machines that do the fabrication.

FLEXIGRIP gives a sleek, trim appearance. The sales advantages it provides are tremendous. It can be used to great advantage to replace the ugly, metal, tooth-type zipper and where the old type zipper could not be employed for one or more reasons. *GET PARTICULARS* **TO-DAY.**

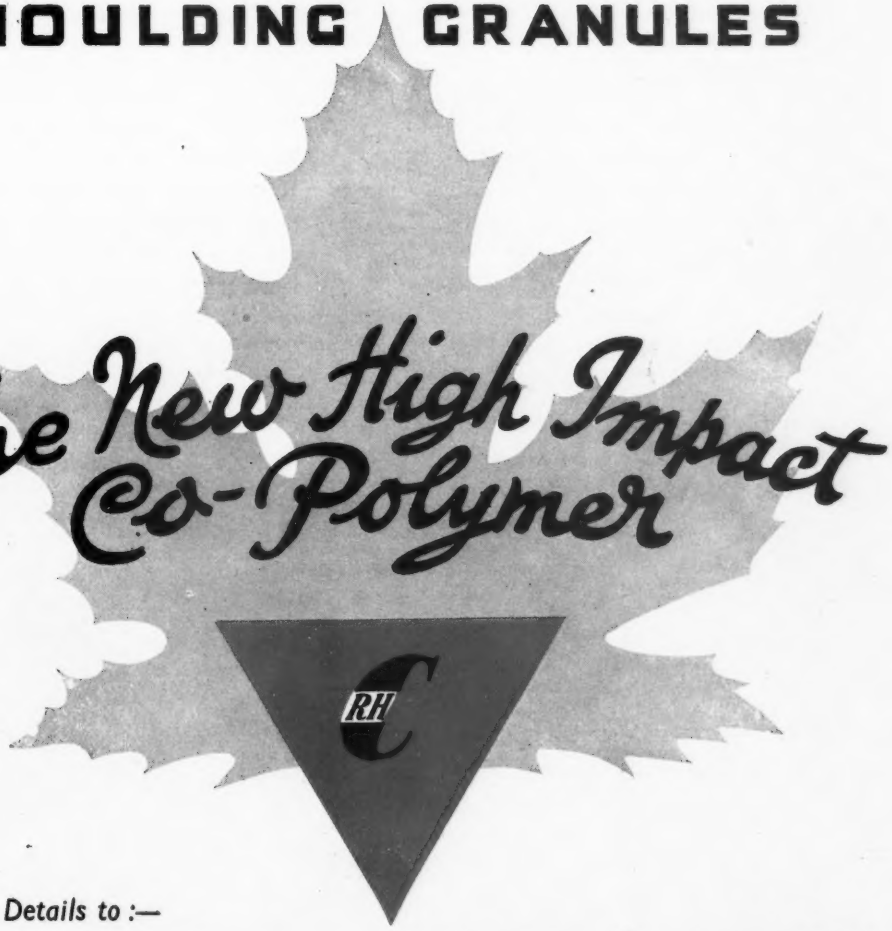
FLEXIGRIP LTD · 113/115 Fulham Road, London, S.W.3. *Telephone : KENsington 8029/2244 Cables : Peanda, London.*

Manufactured in factories in ENGLAND · AUSTRALIA · NEW ZEALAND · FRANCE · GERMANY · BELGIUM · HOLLAND · U.S.A.

Introducing

STYRON 475

MOULDING GRANULES



The New High Impact Co-Polymer

Write for Details to :—

R. H. COLE AND COMPANY LIMITED

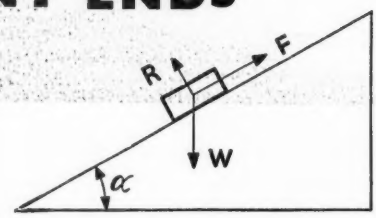
2, CAXTON ST., WESTMINSTER, LONDON, S.W.1.

'PHONE : ABBEY 3061 (10 LINES). 'GRAMS : GERATOLE, PHONE, LONDON.

Product of Dow Chemical of Canada Ltd

BAKELITE Materials

THE MEANS TO MANY ENDS



LOW FRICTION

For components which are required to be self-lubricating, use is made of BAKELITE graphite-loaded materials. This results in mouldings with low friction working surfaces which will operate smoothly for many years. It is possible to combine self-lubricating properties with physical strength, water and chemical resistance, etc. to meet the particular requirements of industry.

(1) Self-aligning bearing for aircraft
(2) Bushing for airscrew actuating link
(3) Gas meter valve assembly
(4) Seating for glandless plug cock

The special-purpose BAKELITE Materials solve many problems of design . . . of strength and durability . . . of weight . . . corrosion, heat and moisture resistance. As new specialised needs arise in industry BAKELITE Moulding Materials to meet them are developed, tested and passed for production.

BAKELITE

TREFOIL
MOULDING MATERIALS
REGD. TRADE MARKS

BAKELITE LIMITED · 18 GROSVENOR GARDENS · LONDON · SW1
P39

Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

PROPRIETORS: TEMPLE PRESS LIMITED

CHAIRMAN and MANAGING DIRECTOR: ROLAND E. DANGERFIELD

CONTENTS

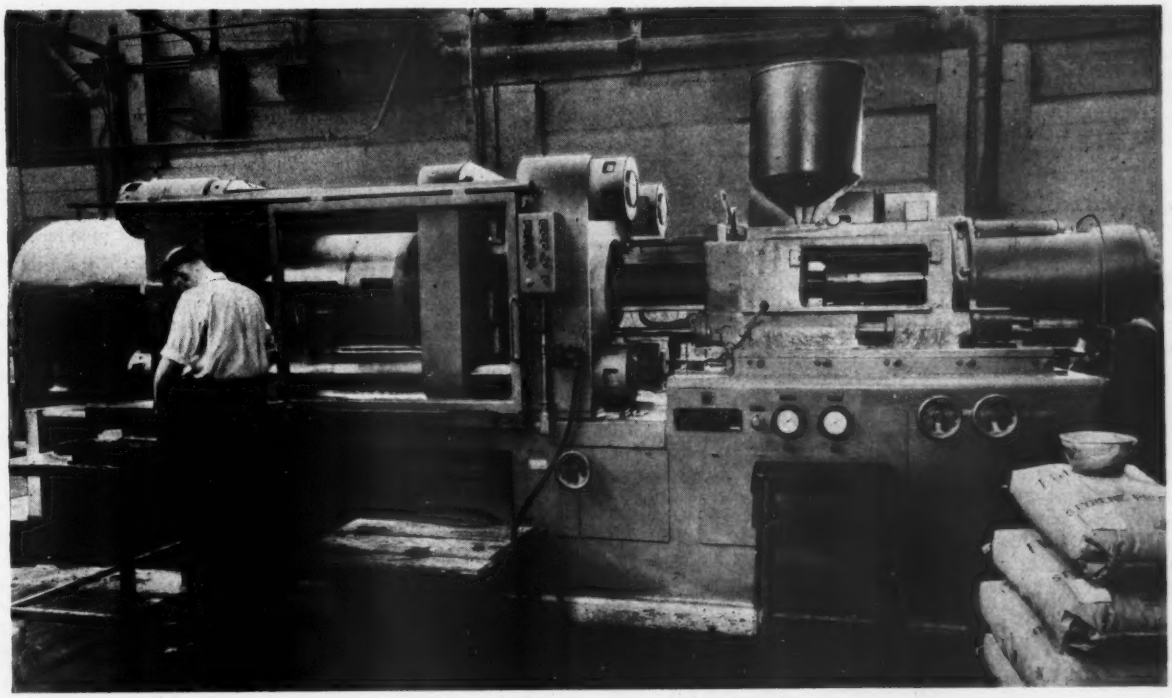
	Page
Editorials	303
Moulding Powder and Shot	304
Thermoplastic Honeycombs, by George May	305
Some Basic Ideas on Adhesion, by N. A. de Bruyne	308
Cementing Thermoplastic Mouldings, by Vivian Stannett and W. D. Jay	310
Plastics in the Service of Man	312
World's Industry Employs Plastics	316
Utilization of Ultrasonics in the Plastics Industry, by W. S. Penn	317
Letters to the Editor	319
New Productions	320
Production News	321
The E.M.B. No. 9 Injection Moulder	324
New British Standards for P.V.C.	327
Successful Design for Plastics Moulding, by W. M. Halliday	328
Patents Review	332

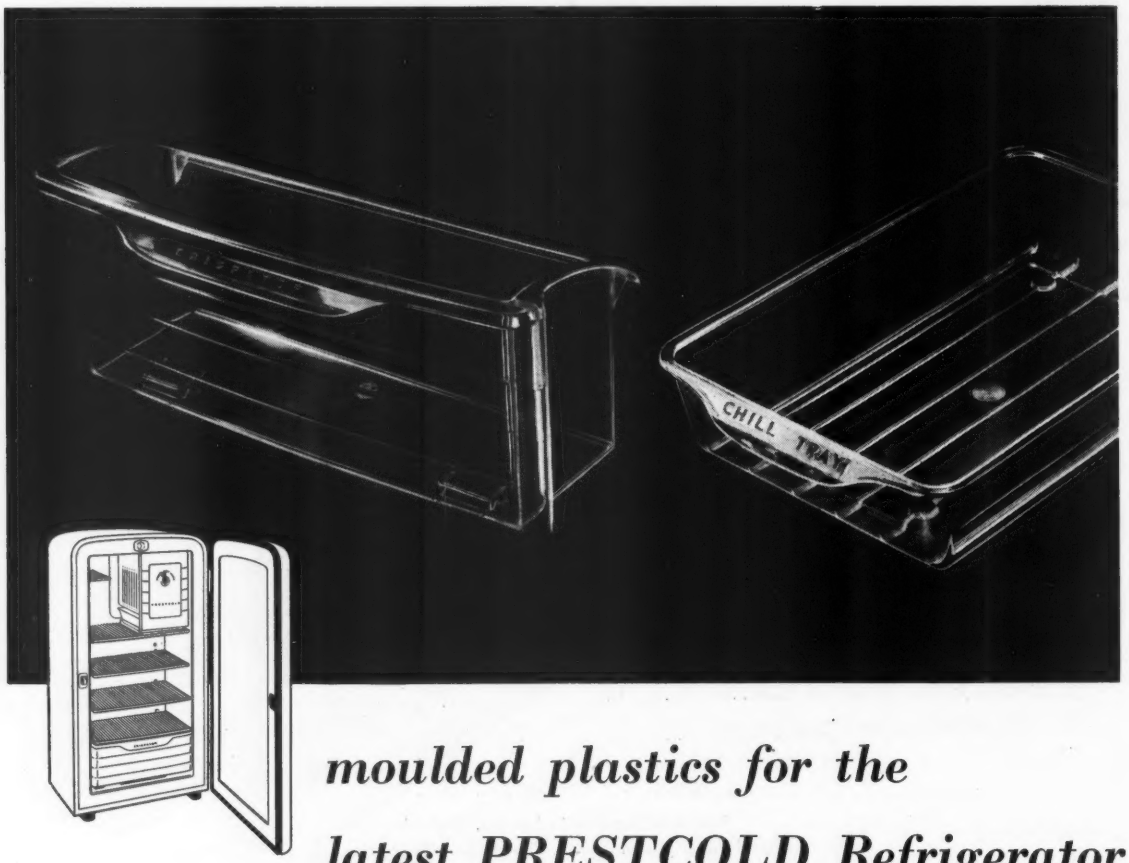
EDITOR: M. D. CURWEN, B.Sc., A.R.I.C.

Published monthly in London, England.

Annual subscription rate 34/-. Shorter periods pro rata.

Watson-Stillman 48-oz. injection moulding machine (Watson-Stillman Co., Roselle, New Jersey, U.S.A.) in use at the works of E. K. Cole, Ltd., Plastics Division.





moulded plastics for the latest PRESTCOLD Refrigerator

Photographs published through the courtesy of the Pressed Steel Co. Ltd.

The lightness, clarity and cleanliness of moulded polystyrene make it a most attractive material for refrigerator fittings. Large injection moulding presses at the Walthamstow works of British Moulded Plastics Ltd. make possible the quantity production of trays such as these, made exclusively for the L.71 seven cubic feet model of the Pressed Steel Co. Ltd. of Oxford.

The 'Crispator' is 20 ins. long and 8 ins. deep while the 'Chill Tray' measures 15 ins. long and 10 ins. wide. The injection moulds for both articles were designed and made at our Walthamstow factory.

BM158

BRITISH MOULDED PLASTICS LTD
37 PORTMAN SQUARE • LONDON W1 *WELbeck 3934*

MOULDED PRODUCTS LTD
CHESTER ROAD • TYBURN • BIRMINGHAM 24 *Erdington 2201*

TWO NATIONAL PLASTICS COMPANIES

Plastics

VOL. XVI. No. 172 NOVEMBER, 1951

"To all whom it may concern: Be it known that I, Leo H. Baekeland, a citizen of the United States, residing at Snug Rock, Harmony Park, Yonkers, in the County of Westchester and State of New York, have invented certain new and useful Improvements in Methods of Making Insoluble Condensation Products of Phenols and Formaldehyde . . . In practising the invention I react upon a phenolic body with formaldehyde to obtain a reaction product which is capable of transformation by heat into an insoluble and infusible body, and then convert this reaction product, either alone or compounded with a suitable filling material, into such insoluble and infusible body by the combined action of heat and pressure."

U.S. Patent 942,699, application filed July 13, 1907.

EDITORIALS

Capacity for Production

FOR many years now we have urged the collection and publication of figures of production. We remember our earliest efforts in the field of raw materials—of moulding powder and other synthetic and semi-synthetic resins—the figures for which were kept locked in the bosoms of the very few; it was not impossible that no one person knew the complete answer. We believed that the whole plastics industry and, indeed, the country should for sound economic reasons know how much the chemical factories were making and where we stood vis-à-vis other manufacturing countries. One of our early attempts at dispersing the fog that surrounded us consisted in an ironic exposure of the methods adopted by important individuals in the industry, scientific, technical and industrial, in referring to the strength of our industry by such terms as "considerable increase in production," "large quantities of polythene are now being made," "the output is now about twice that of 1938" (often immediately after having given the American production in very exact figures). Nobody, except ourselves, appeared to see the grim humour and the futility of such expressions. At least no other words appeared in print.

It was not until 1950, as a result of the demand by the Government to the Association of British Chemical Manufacturers and then to the British Plastics Federation, that such figures were made available together with the proposed expansions. The results, which were published in the March, 1950, issue of this journal, were enlightening and tremendously encouraging to all who had the welfare of the industry at heart—a light had blazed and had shown the world and ourselves what we were doing and what we were going to do. (In passing, our recent objections to the proposed expansions as being short of actual needs in the face of the new re-armament programme, appear to have support from the excellent news that Forth Chemicals, Ltd., the new organization created by British Petroleum Chemicals, Ltd., and Monsanto Chemicals, Ltd., has decided to expand the production of styrene monomer beyond the original conception.)

During the past few months we have again returned to the general subject, this time focusing our attention on that other section of our industry—the consuming end—and the capacity of the moulders and fabricators to absorb the aforesaid raw materials. If the figures for the one are important, no less are those of the number of machines and their capacity to turn the plastics into useful goods.

We published last month what appear to be fairly accurate figures of the number of injection machines working in 1950 in the U.S.A. (5,483 machines; capacity 27,000 ozs.) and in France (1,400 machines; capacity 4,000 ozs.). This month we are able to publish on page 322 some figures for the British industry which the British Plastics Federation has collected for 1949 and 1950; the analysis gives both compression moulding capacity and injection machine capacity possessed by the moulder members of the Federation only.

For comparison with the American and French figures we can only deal with injection machines, the British figures being 589 machines with 2,148 ozs. capacity.

While these figures are interesting and obviously valuable to the Federation in knowing the strength of its members, they serve no exact guide as to the total strength of the injection-moulding industry. Inquiries at the Federation offices indicate a belief that its moulder members represent 70-75 per cent. of the total number in the country. If this is a fact we are faced with a figure of roughly 95-100 injection moulders in the whole country. On the other hand this method of proportionate estimation cannot give even an approximate figure for the moulding capacity of the presumed 100. In any event we are left with the assumption that we lag very much behind France and that when compared with the U.S.A., we are very small beer. In France there are about 450 factories (most of them probably quite small) carrying out injection moulding.

We can only hope that the Federation estimate of 70-75 per cent. is not accurate and that those injection moulders outside the Federation are more numerous and larger than is commonly supposed.

However this may be, it is clear that an accurate analysis is of importance and that the net of inquiry must be flung wider. There are two important sources of help—the makers of the machines and the Census of Production Office of the Board of Trade.

The Lacquering of Mouldings

A LETTER in last month's issue of this journal on the treatment of polystyrene with lacquers, demonstrates once again the variety of demands on plastics in general which are not always fulfilled by the "straight" moulding. The coating of plastic surfaces with metal was attempted in the early days of the industry and is now in general use in a few factories. The decoration of moulded units with transfers or printings or hand paintings is common and from a technical point of view the hardening of the surface of "acrylics" for optical purposes has been attempted.

The use of the transparent lacquers in this field is quite

new and since so many of the stoving type give exceedingly hard and tough films many advantages are claimed for their use. Obviously the beauty of the surface may be enhanced either by eliminating surface inequalities and producing greater brilliance or alternatively by giving depth to the basic colour of the moulding. Furthermore many of the new synthetic resin films are more resistant to scratching, to abrasion and to the action of certain solvents than some thermoplastic resins and, again, can provide a measure of anti-static effect.

The process is one of simple spraying followed by stoving at, say, 120 degrees F. for thermoplastic resins. We have never heard of their application to mouldings made from thermosetting moulding materials but this could be carried out at much higher temperatures with increased production rate. It would be interesting to know the possibilities of the latter application especially so far as improved water resistance is concerned. Lacquering in any form introduces more complexities to the moulder but it may be worth the trouble.

MOULDING POWDER AND SHOT

Home from Home!

I hope that no reader will make unwarranted inferences from what follows, as to how or where I spent the earlier years of my life, but I must say that I read the recently published Prison Commissioners' Report for 1950 with more than ordinary interest. The production of mailbags has almost disappeared and has gone the way of oakum picking, which was so bad for the finger-nails. What is even more pleasing is that the cafeteria is general and that the enamel food dishes have gone. They are being replaced by the plastic type, which will no doubt delight not only old and new lags, but also the plastic industry. Any plastic cup or plate would be better than the old enamel ones, of course, but a few may regret their passing. You can't make much clatter with the new things if you want to draw the warders' attention or create a fuss. As a dear friend of mine recently said, "Look 'ere, chum! I doan' mind the polymethylmethacrylate nor the polystyrene ones, nor yet the melamine ones. It's the polyethylene ones that gits me goat. Lumme, yer can't git a sahnd aht of 'em!"

* * *

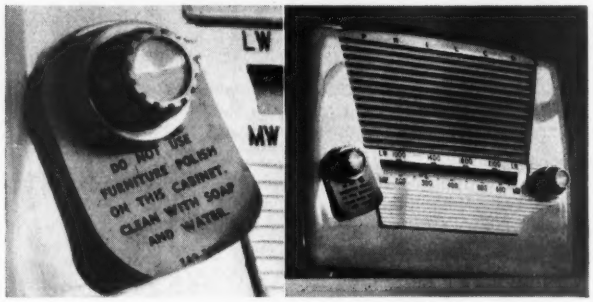
Election News

I heartily congratulate Injection Moulders, Ltd., of Westmoreland Rd., London, N.W.9, for their wit and perspicacity in producing the little plastic "button-hole" of Mr. Winston Churchill, complete with cigar, which was worn by thousands of admirers of our "Grand Young Man" during the election; it was, surprisingly for its small size, an excellent portrait, too. The "button-holes" were, of course, distributed free, and I am sure cheered up everybody who wore them or saw them.

* * *

Beware Chemical Names

In our July issue I recorded two pamphlets, one in French and the other in German, both describing the "Doidy" cup, as examples of how distributors are telling the public the advantages of plastics and how to use them properly. There was, however, in my opinion, one fault: the mention of the word melamine in the texts, this being the plastic material in which the cup was manufactured. Readers may remember that a year or so ago I criticized the Americans for a like fault, for using the words "polystyrene" and "polythene" in an otherwise brilliant set of suggested examples of informative labelling. I am convinced that it will lead us eventually into an awful mess from which it will be difficult to wriggle out. The number of different plastics is already large, some apparently identical even to the expert eye, and their number is growing rapidly. A case has already arisen where a manufacturer has changed over from cellulose acetate to cellulose acetate-butyrate and has been wondering whether he can tell the public the good news! Again, suppose the experimental polymethyl chloracrylate which will certainly be in the "non-inflammable" category and tougher than polymethyl methacrylate were to prove a future new material for the industry? What on earth would the public make of such strange names, especially if trade names are also used in conjunction with them. The system reduces itself to an absurdity. Let us give the public something it can read and understand and tell it that "the material from which this grommet (or helmet or saxophone!) is made is the newest (or oldest) of the big family of plastics. It will last your lifetime or nearly, so long as you don't hit it with a sledge-hammer or boil it in strong nitric acid. It contains your favourite perfume and tastes of strawberry jam." What could be clearer? Another recent example of



good informative labelling is given by the new Philco B2601, shown in the accompanying photograph, with a suitably inscribed label attached to a knob. The inclusion of a note to avoid using furniture polish is interesting in view of the fact that it is sometimes recommended in the literature as a destaticizer. I think Philco are quite right in doing so since some polishes contain aromatic solvents which attack polystyrene.

* * *

Ekco's New Baby

The dinner-dance recently given to celebrate Ekco's 25th anniversary was especially enjoyed by a plastic contingent consisting of Cyril Dingley, Cyril Last, Gilbert Dodd, Phillip Morgan, myself, and our wives, loosely controlled by the cheerful David Radford, General Manager, Ekco's Plastics division, and his wife. It resulted in an invitation to go down to Southend to see a few "bits" of new machinery that had been installed there since my last visit several years ago. One of the "little bits" consisted of a brand-new 48-oz. Watson-Stillman injection moulding machine, which is perhaps the biggest in the country. It is a beauty and was running very smoothly, being "run in" by the production of the deep ice-cream cabinet door which was shown at the recent Plastics Exhibition on the company's stand. Mr. G. O. Collier, works manager of the Plastics Division, has recently returned from the States, and told me that quite apart from producing large mouldings these large machines, including the 200-oz. and the 300-oz. type, are of special value in producing deep, thick mouldings. In effect, it is often the high available pressure that is sometimes required and not necessarily the large area.

DOGSBODDY.

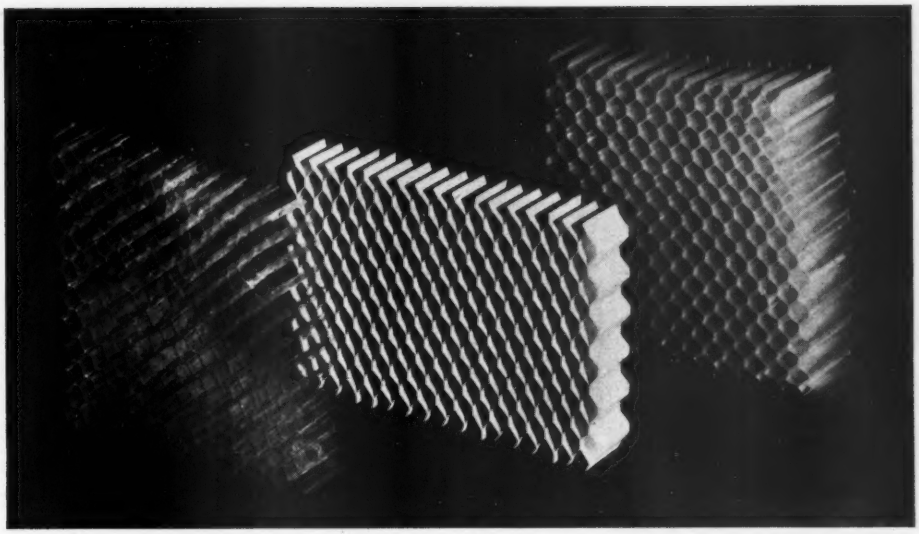


Fig. 1.—Experimental cellulose acetate honeycombs made from transparent, opaque and translucent foil in thicknesses which may range from 0.0025 to 0.01 inch.

Thermoplastic Honeycombs

By GEORGE MAY

LOW-DENSITY materials, in great variety, have been developed extensively in Britain during recent years. These may be classified in two main categories: the resilient, foamed-rubber latex type, and rigid products used for constructional purposes. The latter can be subdivided into low-density materials, which are made by chemical expansion; and the mechanically-formed products, of which honeycomb is an example.

Used as lightweight cores for laminating between thin sheets of higher-density products (which may be of plywood, metal or plastics), low-density materials make possible the manufacture of stable structures far in advance of the original solid laminates, but which, although much stronger than natural wood, have become less favoured on account of being extremely heavy.

Materials used to make cores for structural purposes may be arranged or expanded to take up to as much as 60 times their original volume, and cutting to required thicknesses in preparation for laminating is usually slow and costly. This disadvantage, however, does not apply to honeycomb manufacture, as cutting takes place before expansion, and the knife or saw is called upon to deal with an area of only one-sixtieth of that of the fully expanded material.

Being able to support over 10,000 times its own weight, structural honeycomb (comprising 100 per cent. all-wood kraft paper resinated with phenol-formaldehyde) has been accepted as being the most advanced low-density core, with an established reputation of having the highest strength/weight ratio of any material so far developed. Manufactured under the trade name of "Dufaylite," this high technical efficiency has been achieved by close collaboration with the Royal Aircraft Establishment at Farnborough. In both manufacture and application, such work on structural honeycombs in this country appears to be well in advance of that in the U.S.A.

Influenced by economics, the most extensively applied honeycomb, particularly in the building and allied trades, has been that made from resinated paper; but it is not generally appreciated that other materials have also been successfully converted to cellular form by the patented process used in the manufacture of "Dufaylite."

For example, cotton fabric honeycombs, impregnated with thermosetting resins, have been developed for use in aircraft structures, while specialized applications connected with airborne radar require the lattice to consist of woven glass-fibre cloth stabilized by treatment with the polyester resins. Synthetic adhesives have solved problems in manufacturing metal honeycombs and, in general, successful development of the various structural honeycombs has been largely dependent on the use of selected products from the wide range of materials made available by the plastics industry.

Influenced by the latter experiences, the writer turned his attention to the possibilities of converting thermoplastic sheet materials to honeycomb form. To commence such an investigation, cellulose acetate appeared to be an agreeable material, as it was available in suitable thicknesses and also as transparent, translucent, coloured, pigmented or textured film. Such a range of variable factors, combined with selected cell sizes, seemed likely to provide honeycombs adaptable enough to cover a wide field in the development of their applications. This trend of thought was stimulated by the constant flow of ideas suggested by enthusiastic manipulators of structural honeycombs, including proposals which would only be really effective if the materials were available in thermoplastic and decorative forms.

Perhaps the most difficult phase in the development of thermoplastic honeycombs has been the discovery of suitable adhesives. These, of necessity, are required to provide efficient localized bonding, together with adaptability to mechanical application in a practical manner. The search, carried out by trial and error, took some considerable time, but once a convenient formula had been established, it was found possible to make cellulose-acetate honeycombs using the "Dufaylite" process. Experimental examples are illustrated in Fig. 1.

The basic principle of mechanically made honeycomb consists in depositing lines of adhesive on to sheets of material in such a way that the sheets are accumulated to form a block

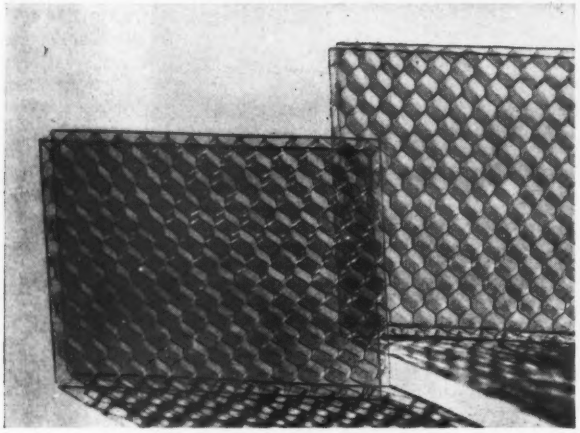


Fig. 2.—Transparent sandwich construction, comprising cellulose acetate honeycomb cores laminated between (left) glass and (right) "Perspex," using plastics adhesives.

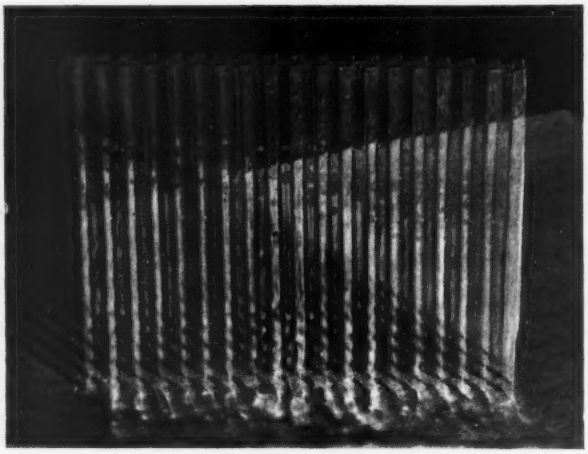


Fig. 3.—Transparent honeycomb, two "cells" in depth, forms a rigid and effective safety substitute for glass.

of predetermined thickness. By means of a reciprocating platen, the position of the adhesive lines is varied, so that those applied to every other sheet are registered exactly midway between the lines on the preceding and succeeding sheets. It is convenient to use the material in sheets measuring 25 ins. by 18 ins. After these have been made up into block form and cut transversely in sections of prescribed depth, honeycomb 12 ins. wide is obtained after expansion.

Sections made with the thinner foils or having large cell sizes may be expanded and collapsed without effort, but thicker sheets, particularly if combined with a small cell size, require to be assisted by heat. Immersion in hot water is an agreeable way of carrying out this operation and makes full use of the thermoplastic characteristics of the material. The softening action enables sections to be expanded easily and, when "set" by cooling to room temperature, "stabilized" cellular panels are formed, varying in rigidity according to the cell size selected and the thickness of foil used.

For most purposes, it is preferable to expand thermoplastic honeycombs by heat treatment, especially when they are required to function as cores for laminated sandwich construction.

Laminating the cores between "skins" (the thickness of which is usually to the order of $\frac{1}{16}$ in.) has proved to be comparatively simple, and the advantages gained include a very considerable saving in raw materials. For example, a $\frac{3}{8}$-in. cellular core, laminated between two $\frac{1}{16}$-in. flexible sheets of practically any plastic material, will result in a rigid panel less than one-third the weight of a solid panel of the same overall thickness.

Fig. 2 illustrates transparent honeycombs laminated between thin sheet glass and also "Perspex." The former example is particularly interesting as it suggests a remedy for certain condensation problems and, due to the use of plastic adhesive, the sandwiched structure behaves in a similar way to safety glass when subjected to forceful impact.

Apart from their application as cores for the manufacture of transparent laminates, plastic honeycombs in the open cellular form are extremely versatile and likely to be adapted to even more extensive uses in other directions. Prototypes of louvres for fluorescent tubes have already been made as a suggested means for screening this type of lighting which tends to become increasingly popular. Using white cellulose acetate film and a comparatively large cell size for economy, this combination successfully camouflages the direct glare of the tube, while at the some time allowing agreeable diffusion and good reflection of light. (Fig. 4.)

Further experiments in manipulation, as shown in Fig. 5,

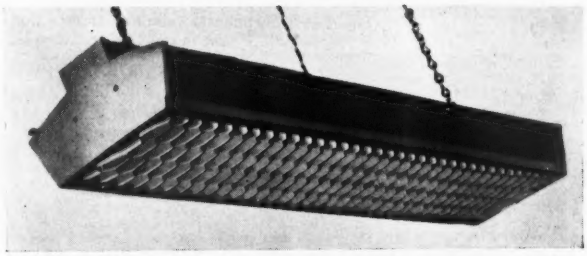


Fig. 4.—White, pigmented cellulose acetate honeycomb used as louvres to screen tubular fluorescent lighting. Before expansion, the section is profiled to fit the frame.

indicate that plastic honeycombs may attract the attention of designers desirous of using a minimum quantity of material to maximum advantage. It is possible to join the ends of sections to form circles, cones or tubes; and to stabilize these forms by bonding them together with a suitable adhesive; or alternatively, by introducing mechanical supports such as metal rings or discs. Provision for fixing the inserts is allowed for by making notches in the unexpanded section, and when joined into a tube the characteristics developed by the honeycomb include a natural tendency to conform to a "saddle" shape, together with a spring tension which holds the stiffeners in position as determined by the series of notches. The latter feature not only encourages a simple system of assembly, but also provides a means whereby the structure may be readily collapsed for packing.

By selecting suitable cell sizes, attractive grilles for ventilation and air conditioning can be foreseen as a further application for plastic honeycomb; and a medium such as coloured cellulose acetate has an advantage over metal inasmuch as that the application of paint to a particularly difficult surface area need not be considered. It is well known that a honeycomb structure is ideally suited for giving an even air flow; the air may also be directed by arranging the cells at any suitable angle.

Sloping cells as distinct from perpendicular cells are obtained by providing the glue lines at a suitable predetermined angle required in the final product; no other modification is needed in the process of manufacture.

It is also practical to divide the block of accumulated sheets in the direction parallel to that of the adhesive lines. When this is done, so that all the laminated areas are bisected, there is produced a flexible material having a "plaited" effect and greater directional rigidity than the original cellulose acetate foil.

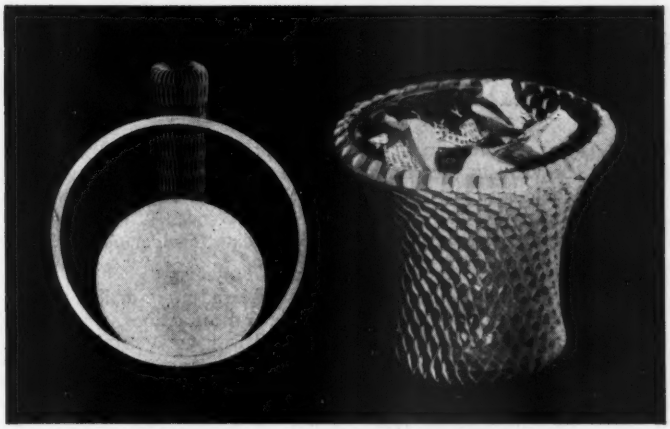


Fig. 5.—Left: Honeycomb section of given size, notched and jointed, together with ring and disc for expanding. Right: The three components assembled to form a waste-paper basket.

Cutting through every other adhesive line provides a section, which, when expanded, contains a single row of complete honeycomb "cells" and has greater rigidity than the "plaited" material. The latter, being only one half "cell" in depth, can be conveniently rolled, whereas expanded panels incorporating a row of unbroken "cells" should be regarded as "flat" sheets and treated as such. Fig. 3 illustrates a specimen made from 0.005-in. transparent cellulose acetate sheet. This is two "cells" in depth, with an overall "thickness" of 1 in. and which could be regarded as a safety substitute for glass.

The flexible, "plaited" plastic, however, appears to suggest a greater variety of applications, especially when coloured sheet is employed, and the manufacture of lampshades is one fairly obvious choice. The example shown in Fig. 6 demonstrates a simple method of assembly. No complete supporting framework is essential, and sections calculated to suit the required dimensions are notched before expanding and joining into tubes, so that they may grip the rings which give final shape to the shades. The "plaited" form may also find uses in making colourful display stands in the shape of simple tubular columns.

Further development by practical experiment has shown that it is possible to produce "plaited" sections which are curved. This is achieved by a simple modification in the application of adhesive lines and may also include the combination of a straight line and curve, a feature which offers further scope in design.

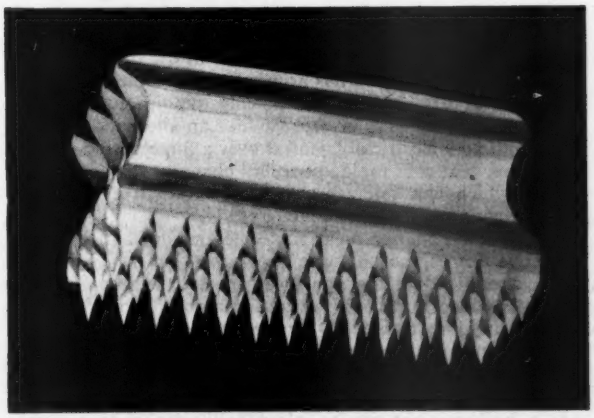


Fig. 7.—A variety of shapes may be punched from thermoplastic honeycomb. This experimental hairbrush is 3 inches long, weighs only one-eighth of an ounce, and is thrown away after use.

Fig. 6—Pendant lampshades, erect and collapsed, demonstrate method of assembly.

Profiled sections cut from a normal block of unexpanded "honeycomb" have also been considered. The great variety of interesting shapes which are obtainable are well suited for spraying with "plastic envelope" solution, and when a fine artificial "cobweb" has been applied, this will support a sprayed coat of cellulose lacquer which completely seals all open cells.

The discovery of interleaving the cellulose acetate sheets with an incompatible material, such as "Cellophane," led to more ambitious experiments. By the insertion of "Cellophane" sheets at predetermined intervals during the laminating process, and after expanding sections of the material, it was found possible to divide the panels of honeycomb into smaller sections, each containing a given number of cells. The comparatively poor quality of adhesion between "Cellophane" and cellulose acetate made this method of separating quite practical.

Sections of expanded honeycomb divided in this way may be more elaborately shaped by a cutting die, using a hand- or power-operated fly-press. The action of the cutter compresses the honeycomb so that only the minimum thickness of material has to be dealt with, and after release from the cutting operation, the shaped article recovers to its expanded form. Fig. 7 is a photograph of an experiment in shaping by the latter method. The result is a suggestion for producing a hairbrush, which is economical enough to allow the brush to be discarded as readily as a paper towel. Both the "grip" and the "bristles" are formed from one piece of plastic honeycomb.

There appears to be little doubt that the availability of thermoplastic honeycombs would mean the introduction of a very subtle new medium to the creative designer, and even though at present the raw material supply position is not encouraging, long-term development continues.

In addition to cellulose acetate, other sheet materials under consideration for conversion to cellular form include plasticized polyvinyl chloride, rigid polyvinyl chloride and polyethylene. Patent rights covering methods of manufacturing mechanically made honeycombs have been assigned to Dufay-Chromex, Ltd., Elstree, Herts.

Some Basic Ideas on Adhesion

By N. A. de BRUYNE, M.A., Ph.D. (Cantab.), F.Inst.P.

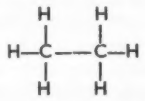
By kind permission of Aero Research Ltd., and of Dr. N. A. de Bruyne, we publish the opening lecture delivered at the Special Summer School held at Cambridge, during September, to study the technical applications of synthetic resin adhesives. Further lectures of particular interest to readers of "Plastics" will appear in subsequent issues.

MATTER consists of atoms and or molecules held together by interatomic or intermolecular forces. These forces are responsible for the cohesion of matter and we believe that they are also responsible for the adhesion of one solid to another. Although all these forces are of an electrical kind it is convenient to class them as (1) primary forces and (2) secondary forces.

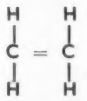
Primary Forces

Primary forces are those forces responsible for the formation and existence of definite chemical compounds. They are distinguished from secondary forces (to be discussed later) by their strength and by their property of saturation. Thus when atoms are held together by primary forces the atoms behave just as though each had one, or sometimes two, three or four hooks, and once each hook is linked up no further combination is possible. Thus one atom of chlorine combines with one atom of sodium to form one molecule of sodium chloride and never 2 or 2½ chlorine atoms with one atom of sodium. The number of hooks on the atom is called its valency. Sodium and chlorine are univalent, each has one hook and never more or less; only one sodium atom can link with one chlorine atom. So, in brief, primary forces obey the laws of valency.

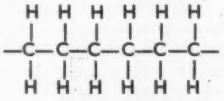
Of all the elements carbon is the one of greatest significance because it forms the backbone of wood, rubber, plastics and adhesives. Carbon has four hooks. It is quadrivalent and for our purposes we can think of a carbon atom as a sphere 10^{-8} cm. in diameter with four arms sticking out of it, each arm representing one of the valencies or directed primary forces. If you put a hydrogen atom (univalent) on the end of each stick you have methane, which the chemist writes CH_4. A more complicated molecule is formed by linking two carbon atoms together and putting hydrogen atoms on the remaining hooks; this is ethane, C_2H_6.



It is even possible to get two direct inter-carbon bonds, as in ethylene, C_2H_4.



This is an unsaturated compound. Such a double bond is a source of weakness, not of strength. The arms have to be severely strained and are longing to fly apart. Such unsaturated compounds are therefore very reactive and are ready to link up to form saturated or less unsaturated compounds. It is by the bursting of double bonds and the formation of long chains of molecules that plastics are formed. Thus ethylene produces polyethylene (polythene), which is a typical example of a long chain compound.



The development of knowledge of wood, rubber and plastics began with the realization that they all consist of such long chainlike molecules made by the repeated linking by primary forces of small molecules called monomers, just as a railway train may be made up by the coupling together of coaches.

Monomers and Polymers

If these chain molecules are rigid and more or less parallel to one another and subject to lateral attractions, we have an anisotropic material such as wood with good strength in one direction but liable to cleave apart at right angles to the chains. If the chains are rigid but in a muddle and tied together at odd places, we get an amorphous isotropic material like "Bakelite." If the chains are flexible, are in a muddle, are not tied together or subject to strong side attractions, then we have a collection of sleepy gas molecules which behaves like a drugged gas—this is like rubber.

Secondary Forces

The monomeric groups are built up into polymeric molecules by strong primary chemical bonds. But the forces between one polymeric molecule and another are secondary forces of a kind far less definite than that of the primary links, and though much weaker they are often in a sense more important than the primary forces, since it is the weakest links which decide the strength of the chain. When rupture takes place failure occurs through disruption of the secondary forces; and the existence of matter in a liquid or solid form is only made possible because of these secondary forces.

In a liquid these secondary forces make themselves apparent by producing what is called "surface tension." The molecules at the surface are subject to an inward attraction, exerted by the molecules inside the liquid, which is not counterbalanced by any outward attraction. The surface behaves as though it were under tension. For this reason the liquid will gather into drops unless it rests on a solid which attracts the molecules of the liquid more strongly than they do each other. If the attraction of the molecules of the solid is great enough to do this then the liquid is said to "wet" the solid.

Roughly speaking, secondary forces between atoms and molecules are of two distinct kinds called "polar forces" and "non-polar forces." These forces are electrical, although the atoms or molecules are themselves electrically neutral. Thus a molecule can be electrically neutral, considered as a whole, although there may be a concentration of positive electricity at one end and a corresponding concentration of negative electricity at the other end of the molecule. Such a molecule is said to have a permanent "dipole moment"; it is the electrical equivalent of a permanent magnet with a north pole at one end and a south pole at the other.

But even if a molecule has no permanent dipole it can exert attractive forces, either by inducing dipole moments on neighbouring molecules or because (like an alternating current supply) though electrically neutral over a finite period of time it is the seat of rapid periodic changes in density of charge which can interact to produce attractive forces on neighbouring molecular systems.

Both polar and non-polar molecules are held together by attractive forces, but because the polar forces are usually much stronger than the non-polar forces, the two kinds of molecule will not mix. If we add non-polar molecules to a polar liquid the attraction between the polar molecules is sufficient to squeeze out the non-polar molecules. The difference between the behaviour of materials in which the molecules are held together by polar forces and those in which the forces are non-polar can be illustrated by a simple experiment with two tubes, glass and polythene respectively, which are filled with water and toluene. The water (polar)

will not mix with the toluene (non-polar) and the two liquids separate into two immiscible layers. At the interface between the liquids the shape of the meniscus shows that the polythene (non-polar) is preferentially wetted by the toluene, while the glass (polar) prefers the water.

Here is a classification of materials into polar and non-polar categories:—

POLAR	NON-POLAR
Cellulose (wood, cotton, paper)	Rubber
PF and UF resins before setting takes place	Polystyrene
Anything with OH groups	Polyethylene
Water	"Teflon"
Alcohol	Benzene
Metal oxides	Mineral oils

Two Basic Rules of Adhesion

If you want to stick a material make sure that you use an adhesive that " wets " the surface, in other words has a similar polarity. That is the first rule of adhesion. It does not guarantee a good joint, because while it is a necessary condition it is not a sufficient one. We must take account also of the stress in the joint.

The second rule is that on solidification the adhesive must not develop a residual stress sufficient to disrupt the bond, nor should the adhesive be much more rigid than the adherends otherwise an external load will give rise to premature failure because of the concentration of stress that will occur. These are the basic necessities for good adhesion.

A simple experiment can be made to illustrate the importance of wetting. A glass plate is coated on one side with paraffin wax; the other side is rubbed clean in running water. A moistened gum tape is now applied and a strip pressed on to each side of the plate. In a few minutes after it has had time to dry an attempt is made to pull the tape off. The tape sticks to the clean glass but not to the paraffin surface.

Water and hydrophilic materials like gum spread out easily in a continuous film over a clean glass surface, but gather up into drops on a wax surface. Wetting takes place when the interfacial forces between adhesive and adherend equal or exceed the cohesive forces of the adhesive. Correspondingly the formation of drops signifies that the interfacial forces are smaller than the cohesive forces. Thus if good adhesion is the direct result of strong interfacial molecular forces we should expect it to be associated with wetting and, conversely, poor adhesion with drop formation.

Probably, however, the connection between strong interfacial molecular forces and strong adhesion is less direct than this argument suggests. Strong interfacial forces cause wetting and give a continuous film; less strong interfacial forces cause drop formation and result in a discontinuous adhesive layer with considerable stress concentration under an external load at the rim of each solidified drop.

Resins soluble in water, such as urea formaldehyde resins, also wet glass, but unfortunately they do not make good adhesives for glass because among other things they disobey the second rule.

If you want to stick rubber, which is a non-polar material, to wood, the best course is to alter the polarity of the rubber which can easily be done by a few minutes' immersion in sulphuric acid. You will then find that the rubber is wetted by water and by, say, urea formaldehyde resins and can be strongly glued. Polystyrene can be treated with fuming sulphuric acid, and polyethylene can be halogenated (B.P. 653029) to enable them to be glued with polar adhesives.

How Metals Are Glued

In everyday life it is almost impossible to get a clean metal surface; in effect a " clean " metal surface is nearly always an oxide surface. Any material that will wet a metal surface and at the same time is strong enough or flexible enough to be unaffected by residual stresses will therefore serve to glue metals. In the " Redux " process we use a polyvinyl formal resin as the adhesive, but because of its high melting point it never becomes sufficiently liquid to run and wet the metal surface. To obtain wetting we first coat the metal with a phenol formaldehyde resin in which the polyvinyl formal will dissolve as soon as the melting point of the P.F. resin is attained.

It is quite possible to make certain metals adhere together by their own surface forces if we take care to obviate high residual stresses. This we can do by using a soft metal such as soft aluminium or indium. Lead should also be suitable but it oxidizes so very rapidly that it is difficult to get it to stick. However, aluminium can be joined to itself at room temperature by (1) removing the original surface by scratch brushing, (2) bringing the new surfaces thus made into intimate contact by squeezing them together.

Porous and Non-porous Adherends

Apart from the possibility of providing mechanical interlocking the existence of porosity in one or both adherends can be of decisive significance in obtaining a sound joint.

Porosity is beneficial in that it allows solvents to escape. It is impossible to make a good joint between non-porous solids with a urea-formaldehyde aqueous solution; " vulcanized fibre " sheet, for instance, has a smooth non-porous surface which makes the escape of water very difficult. If this smooth skin is removed, however, excellent joints will be obtained with an aqueous UF resin. To make good joints between impermeable adherends one must use adhesives that do not give off volatiles. On the other hand, porosity can be detrimental if it allows the glue to run out of the joint.

Adherends can conveniently be classified as polar or non-polar, porous or impermeable, and the type of adhesive must be chosen to suit the conditions. Use polar adhesives for polar adherends. If possible, convert the surfaces of non-polar adherends to a polar state; alternatively, use a non-polar solvent. If both adherends are impermeable avoid an adhesive containing volatiles, or which splits off volatiles on setting.

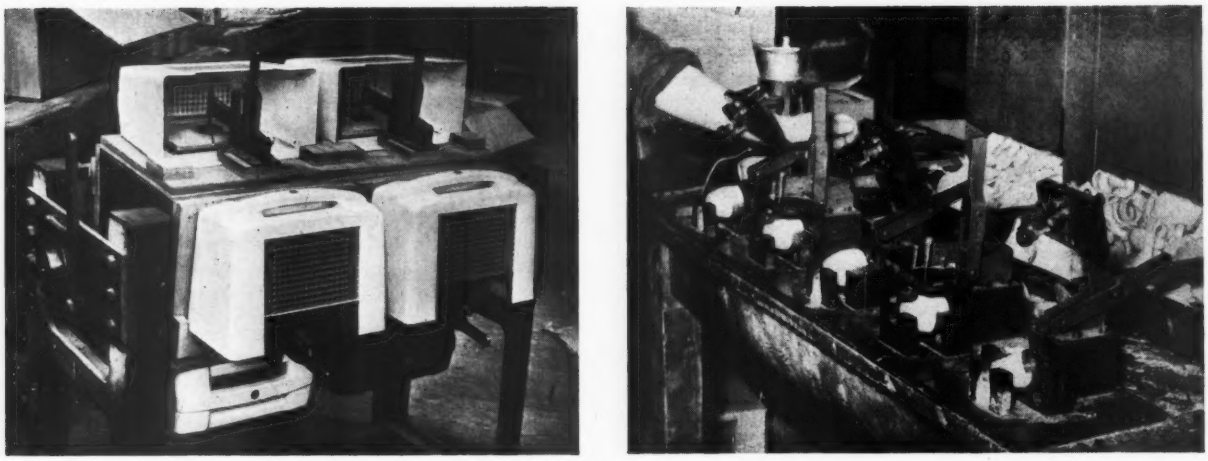
Plastics Fire Hazards

IN view of the interest aroused in the spread-of-flame hazard of certain nitrocellulose lacquers, the Fire Research Station, Boreham Wood, Herts, has carried out tests on samples of plywood treated with nitrocellulose lacquers with different plasticizers (" Fire Research 1950." Report of the Fire Research Board. H.M. Stationery Office. 2s. 6d.). Whereas dibutylphthalate and camphor gave a lacquer which permitted very rapid spread of flame, tricresylphosphate gave a lacquer, the spread-of-flame characteristic of which was not greatly different from that of untreated plywood.

A new transparent plastic, which was similar in appearance to methyl methacrylate was also tested, but was considerably less easy to ignite than either wood or methyl methacrylate, in the absence of supporting radiation. Under increasing incident heat radiation, the ignitability of this material increased until it was equal to that of methyl methacrylate under intense radiation. It had the advantage in that it did not shed burning drops when ignited, and was classified as non-inflammable in the standard test of B.S. 476. (Definitions for Fire Resistance, Incombustibility and Non-inflammability of Building Materials and Structures, including methods of test.)

Comparative tests were also made on plastic and rubber-insulated cables under conditions of external heating and current over-loading. With external heating, the plastic-insulated cables were markedly superior in their resistance to spread of flame, and in that they did not continue to burn after the igniting source was removed. The rubber-insulated cables were unsatisfactory in both respects. The second part of the test (current overloading) did not differentiate between the two types of cable as neither type ignited when passing an overload current twelve times the rated value of 5 amperes.

J



Jigs and clamps for thermoplastics cementing operations at the works of E. K. Cole Ltd., Plastics Division. (Left) Fixing grilles in radio cabinets. (Right) Joining the two halves of a moulded egg-cup.

Cementing Thermoplastic Mouldings—II

By VIVIAN STANNETT, Ph.D., M.Sc., F.R.I.C., and D. W. JAY

In the previous article the types of cement used were discussed, together with general observations on the technique of cementing. The present section describes methods of application of the cements, and treats also of hazards involved in handling them.

THE practical techniques of cementing thermoplastics mouldings were mainly developed in a simple way from the methods used in the glueing of wood. These involved the use of jigs and clamps as holding devices after the cement itself had been applied. Numerous ways of applying the cement by hand are used, including brushes, glass rods and spatulas, oil cans with narrowed nozzles, medicine dropping bottles and hypodermic syringes. A more elaborate, but widely used method is to have a cement tank with a capacity of several gallons fitted with several flexible tubes terminating in jets fitted with press clips or stop cocks. In some cases the tanks are placed above the tank bench and the jets fed by gravity. The preferred method, however, is to have pressurized containers under about 20 lb./sq. in. of air pressure.

Application of Cement by Felt-pad Method

When solvent-type unbodied cements are to be used the felt-pad method is very widely employed. This consists of a flat dish or tray containing solvent kept to a constant level by hand or by a simple constant level reservoir feed. A felt pad covers most of the area of the container and is slightly higher than the solvent level so that it is kept wet with solvent by wick action. The cement is applied to the plastic either by wiping across the surface of the pad or by sitting the plastic on top of the pad until it has softened sufficiently. In the latter case the felt surface can be covered by a wire screen to prevent contamination of the plastic by hairs, etc.

The provision for the tray of a lid which can be raised during use by a simple foot-pedal mechanism is useful. This prevents the continuous evaporation of the solvent. Alternatively, the tray can be partly covered, leaving shaped openings sufficient for soaking the mouldings. This method is very appropriate when long runs of a particular component are being cemented. Even when unbodied cements are used, frequent cleaning or replacement of the felt is necessary to prevent gumming up and contamination.

Little need be said about the simpler methods of application. Brushes are useful when complications of design prevent the use of the felt-pad method. The advantage of using a brush of the correct size should be emphasized. Flowing methods of application are useful when V-shaped joints are involved, whilst spatulas and glass rods are useful with bodied adhesives when large surface areas have to be covered. In all cases it is definitely preferable to apply the cement to both surfaces of the assembly and it has been found that in this way stronger and better joints result.

Joint Design

In designing components destined for cementing into a finished article, the question of joint design should not be overlooked. In general, the larger the surface area cemented the stronger the joint. Several kinds of joint are used, starting with normal butt joints and including V grooves, overlaps and tongue-and-groove varieties. Butt joints are the easiest to form in the mould, but tend to slip during the assembly and clamping stages. For many articles simple cementing lugs are often sufficient or these can supplement butt joints.

It is normally found necessary to hold the pieces together under light pressure after applying the cement, 5-10 lb./sq. in. usually being sufficient. This ensures that the intended bonding surface is held together until the cement sets and avoids the formation of bubbles or voids during this process. Excess pressure must be avoided else distortion will occur and, particularly in the case of polystyrene, crazing may take place. Strain-free mouldings are least liable to crazing. Here annealing is very helpful and gatings should be sited well away from the cementing areas. Warmer moulds and longer moulding cycles may also be found necessary when subsequent cementing is envisaged.

Simpler-shaped components can be held satisfactorily by such simple clamping devices as rubber bands, clothes pegs, and bulldog clips. In these cases a larger number of clips should be used to ensure more even pressure distribution.

For most mouldings, however, these simpler devices are not suitable and specially shaped jigs should be used and held in light toggle presses or spring-loaded devices. Jigs can be made up in wood and covered with soft cloth, or from wood and rubber pads. For fast production rates a number of identical clamps and jigs should be used in rotation so that by the time the last clamp is filled the first is ready for removal. Moulders often find it advantageous to set these

Table 1.—Flash Points and Explosive Limits of Solvents

	Flash Point (Closed Cup) °F.	Explosive Limits (% by volume). Lower	Upper
Acetone	0	2.2	13.0
Benzene	12	1.4	8.0
Diacetone alcohol	48		
Ethyl acetate	24	2.2	11.5
Ethyl benzene	59		
Ethyl lactate	115	—	—
Ethyl acetate	15	4.1	13.9
Methyl cellosolve	107	2.6	14.0
Methyl cellosolve acetate	132	1.7	8.8
Methyl ethyl ketone	30	1.8	11.5
Methylated spirits	60	3.3	19
Styrene monomer	88	1.1	6.1
Toluene	40	1.3	7.0
Xylene	63	1.0	5.3

up on a rotating table so that the single operator can remain seated. Alternatively, a slowly moving belt with two operators can be used.

Finishing operations are best carried out on the complete assembly after cementing.

Solvent Hazards

It should always be borne in mind that whenever solvents are used (as is the case with the cements mentioned) risks of fire and toxicity are involved. These joint hazards will now be discussed in some detail.

TOXICITY.—It is not a simple matter to define degrees of toxicity or to say that this substance is harmless or that one poisonous, as the matter is complicated by the period of contact and the exact circumstances.

In general, however, it can said that the majority of substances used in connection with the common plastics do not possess such dangerous properties that only those with special knowledge can handle them. Similarly, the solvents mentioned in this article can be handled safely in the laboratory or experimental department with moderate care and commonsense precautions. A fairly heavy inhalation of, for example, trichlorethylene would produce giddiness and possibly collapse. Providing the person were removed to fresh air, however, recovery would be complete with no after effects beyond some passing sickness.

The picture is definitely very different when many of these solvents are used regularly over long periods, as in the case of the factory operative. Even low concentrations of vapour can give rise to serious ill-health and permanent damage to body organs when inhaled for eight hours a day for many weeks. It is the purpose of this section of the article to draw attention to these dangers in this respect, and also to indicate where there is a fire or explosive risk, and to offer a few practical suggestions on protective measures.

The use of several of these solvents is governed by Factory Act Regulations. Reference will be made to some of these when applicable.

FIRE HAZARDS.—A physical property possessed by solvents and other substances is the "flash point." This may be defined as the temperature at which the vapour of a substance, issuing from a special apparatus through an aperture controlled by a shutter, flashes as it is ignited by a flame of set size. There are several types of instruments, such as the Abel or Pensky-Martin, and the precise figure depends on the type of instrument used. Flash point vapour pressure and explosive limits of mixtures with air give sound information as to the risks involved in handling a particular solvent.

A list of flash points and explosive limits is given in Table I.

The flash point of acetone is generally given as −17 degrees C., so that it will be observed that at room temperature, say 20 degrees C., the amount of evaporation being very rapid, an inflammable concentration can soon be reached.

It naturally follows that no naked flame may be permitted in a room where acetone is being used in any appreciable quantity. Whilst this is obvious, it is often not so clear that

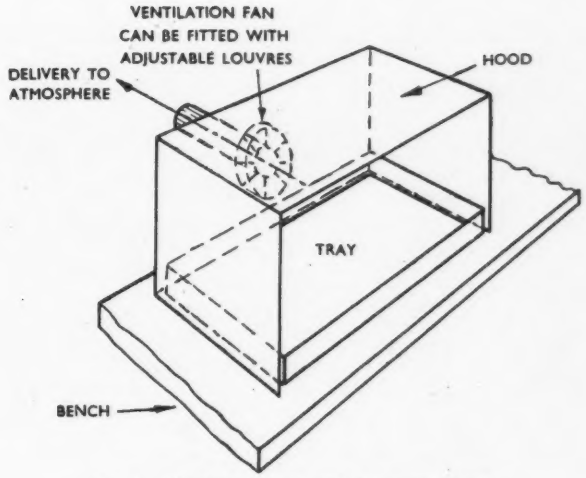


Fig. 1.—Working cabinet, with top extraction for solvent vapours.

electrical apparatus is a source of trouble: an open bar-type electric heater cannot be used, and such a simple thing as the ordinary tumbler switch is a possible source of danger from sparks at the contacts; also, arcing may occur in lamp holders due to weak contact springs. Special "flame proof" safety types are available.

It is with electric motors that special care should be taken. The recommendations in this article call for exhaust fans, and unless the fan-motors are carefully chosen, sparking and overheating may give trouble.

A common type of motor for use on A.C. mains is the squirrel-cage induction machine. This type has no brush-gear to cause sparking; it has a low starting torque but is very suitable for fans. It is not absolutely safe nevertheless, as overheating can occur in the stator coils and sufficient heat may be generated to ignite the solvent vapour. The larger motors of this kind also take a high starting current, which may make them impractical on many circuits.

Flame-proof motors are obtainable from most of the large manufacturers, and in these machines the electrical parts are completely enclosed, so that air from the room cannot come into contact with them. On the larger patterns, ventilation tubes are taken out into the open air through the casing.

Alternatively, the problem may be solved by running the fan shaft through a gland on the ducting, thus keeping the motor away from the vapour. The "series," induction-repulsion and induction slip-ring are common types which all have brush-gear, and should be avoided unless, as suggested, the motor can be sited well away from contact with vapour.

The vapour of all the solvents is heavier than air at the same temperature and in consequence all tend to sink to the floor. Ventilation of work benches may readily be effected by using any of the types shown in the diagrams. However, it is often much more convenient to use top extraction, and this is quite suitable for a working cabinet, as is shown in Fig. 1 when acetone and similar solvents are used.

Toxicity Characteristics of Solvents

From the toxicity point of view, the solvents employed in cementing can be divided into three groups :—

Group I. Low toxicity.
Group II. Risk attached to use.
Group III. Definite toxicity.

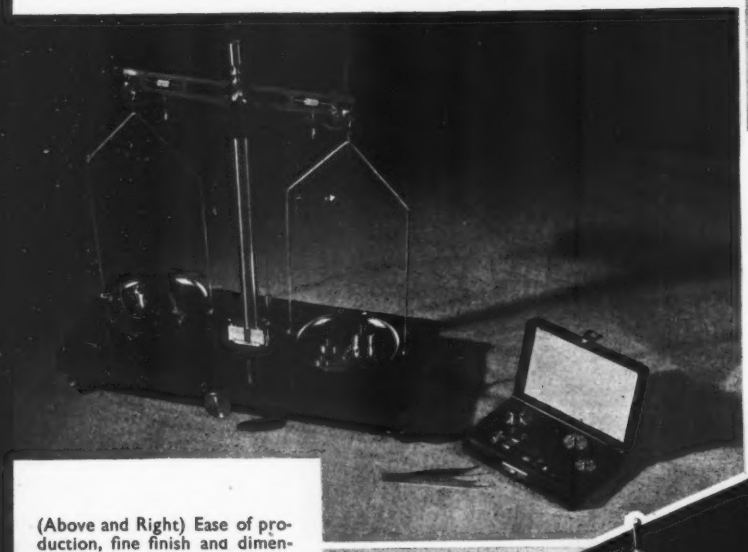
However, even when a substance is practically non-toxic care in handling may still have to be taken, as it may be very inflammable or form an explosive mixture with air.

(To be continued)

PLASTICS
IN THE SERVICE OF MAN

A pictorial review of high-quality units moulded or otherwise fabricated in Great Britain . . .

22. Laboratory Equipment



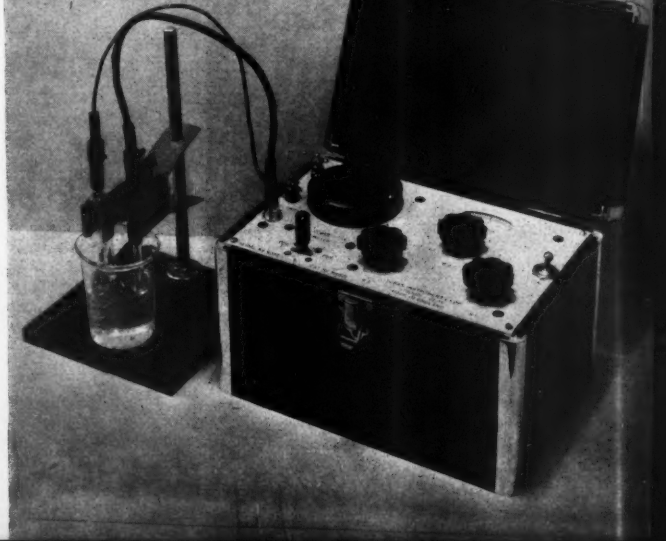
(Above) The "Chloroscope" portable apparatus for testing the purity of water supplies, manufactured by Paterson Engineering Co. Ltd., employs a housing, filter holder, specimen box and container cap moulded in "Bakelite" phenolics by United Ebonite and Lorival, Ltd.

(Above and Right) Ease of production, fine finish and dimensional stability are the reasons why Thomson, Skinner and Hamilton, of Glasgow, have replaced wood with a moulded "Bakelite" base for this balance. The box for weights is another black phenolic moulding.

(Above) This 80 oz. polythene container made by Industrial Appliances Ltd. incorporates a specially designed non-spill pourer moulded of the same material. The rectangular base and tapering sides prevent the bottle from tipping over.

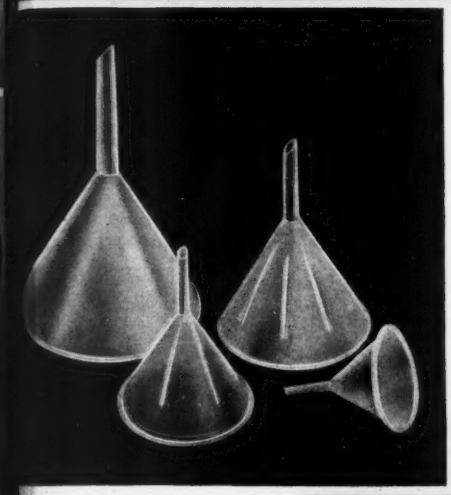
(Left) The four "Bakelite" phenolic mouldings used in the pH meter assembly produced by Muirhead and Co., Ltd., must resist corrosion as well as acting as electrical insulators.

(Right) The housing of the pH meter manufactured by Doran Instrument Co., Ltd., is fabricated from "Bakelite" laminated by H. Comoy and Co., Ltd.



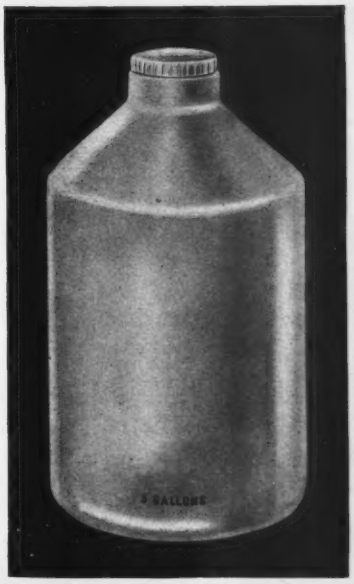
(Left) To show contrast in weight the 84-lb. ten-gallon container of lead (extreme left) is included with this group of polythene fabrications by Rediweld, Ltd. The equivalent polythene bottle weighs 7 lb. ("Plastics," 1948/April/171.)

(Right) Polythene buckets and cans are produced by Tenaplas, Ltd., for transporting strong acids and other chemicals. ("Plastics," 1949/Oct./83).

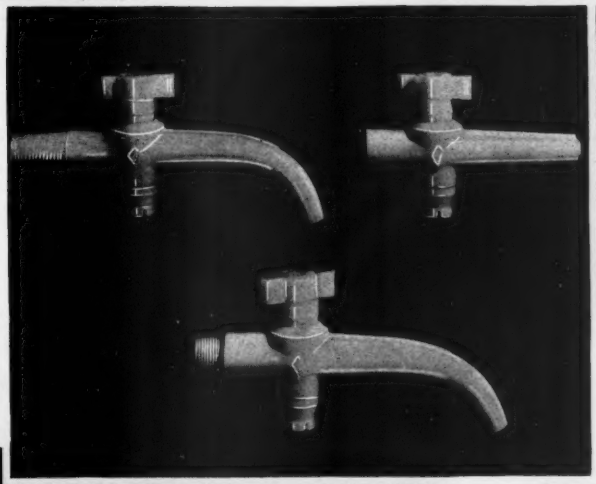


(Left) A range of polythene funnels, injection moulded by J. F. Kenure, Ltd., find many uses in the laboratory.

(Right) Low weight, unbreakability and chemical resistance are the advantages of this "blown" 5-gallon polythene bottle manufactured by Industrial Appliances, Ltd.

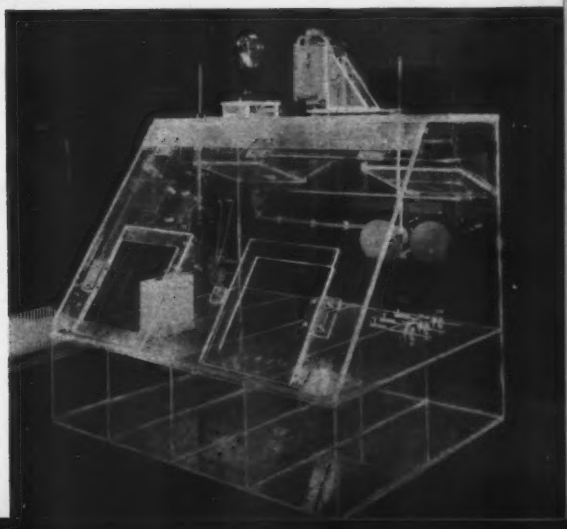


(Below) Another five-gallon container "blow-moulded" in polythene by Cascelloid, Ltd., is contrasted with a one-ounce bottle manufactured by the same company.



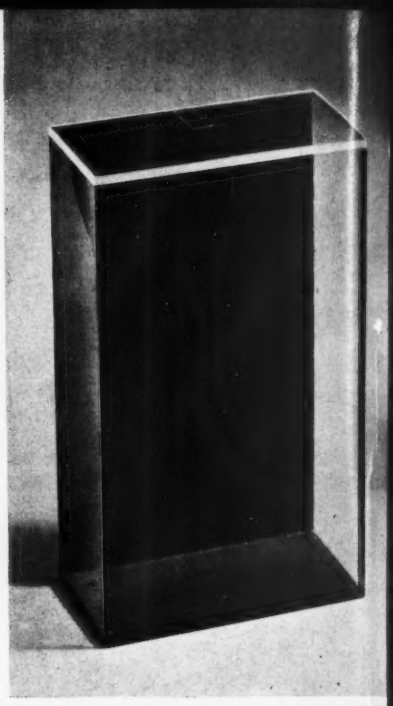
(Right and below) These Polythene taps injection-moulded by Airothene, Ltd., find a variety of uses in chemical laboratories. The funnel, bowl and beaker in the same material are also produced by the company.

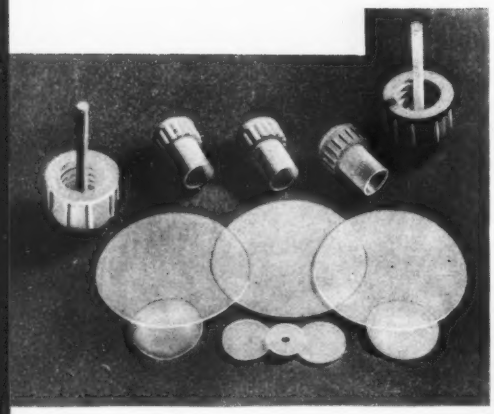
(Below) "Perspex" acrylic sheet is often useful in the construction of specialized laboratory apparatus because of its strength, ease of fabrication and transparency. (Photo: I.C.I., Ltd., Plastics Division.)



(Above) The polythene squeeze-bottle has been adapted by Townson and Mercer, Ltd. for use as a wash bottle with distilled water. It is more convenient than the glass type as traditional method of blowing is avoided.

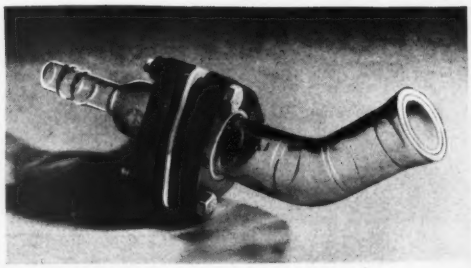
(Left and Right) "Visijar" containers fabricated in "Perspex" transparent and opaque sheet now frequently replace glass jars for storing biological specimens preserved in liquid. The empty box and the sealed one containing a preserved specimen are produced by T. Gerrard and Co., Ltd.

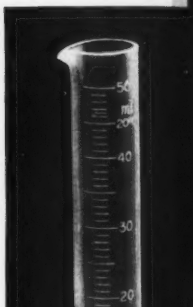




(Above) Stoppers, washers and wads in polythene, moulded by Amplex Appliances, Ltd. are used in the packaging of chemical products. ("Plastics," 1948/June/298.)

(Right) Moulded "Bakelite" phenolic flanges are used in the joints between sections of "Pyrex" glass pipes made by A. Jobling and Co., Ltd.





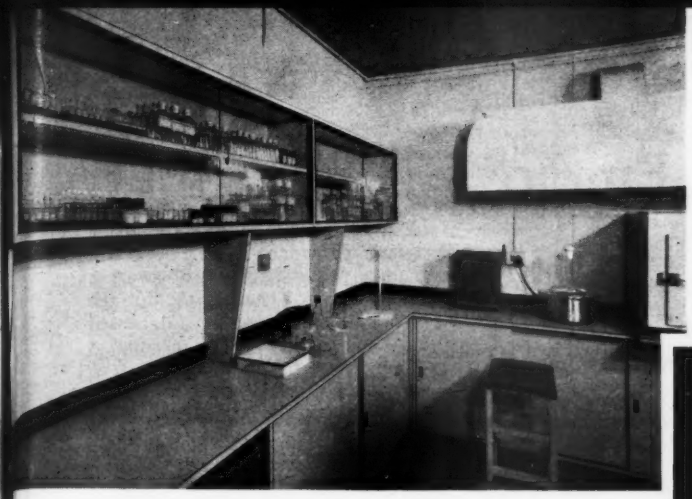
(Right) Measuring cylinders are fabricated from "Perspex" transparent acrylic sheet by T. Gerrard and Co., Ltd.

(Above) Biological specimens are preserved by E. M. Cromwell, Ltd., by embedding in solid transparent "Marco" cast resin. (Scott, Bader and Co. Ltd.)

(Above) Another container made in polythene by Industrial Appliances, Ltd., is this tube with integrally moulded stopper. It finds many uses in the laboratory.

(Left) The laboratory filter pump manufactured by W. and J. George and Becker. Ltd., makes use of a black phenolic moulded housing.

(Right) Blue polythene bottles with 20 oz. and 40 oz. capacity used for storing and transporting pharmaceutical and other chemicals are produced by Industrial Appliances, Ltd.

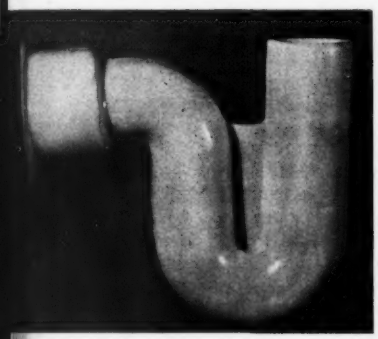


(Above) The working surfaces of the preparation room and aseptic laboratory at St. George's Hospital, London, are covered with pink linette "Formica" laminate. (Photo: Thomas De La Rue and Co., Ltd.)

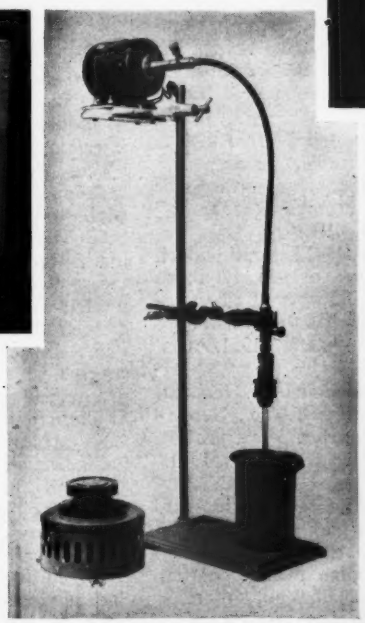
(Right) The bottle-stands in this dispensary of a London hospital are surfaced with "Formica" laminated plastics panels. (Photo: Thomas De La Rue and Co., Ltd.)

(Right) These "Visijar" covers made of transparent "Perspex" are supplied by Baird and Tatlock, Ltd., as microscope covers.

(Below) In the dark room of a London hospital's X-ray department the splash boards as well as the sink surrounds are surfaced with "Warerite" laminated plastics. (Photo: Warerite, Ltd.)



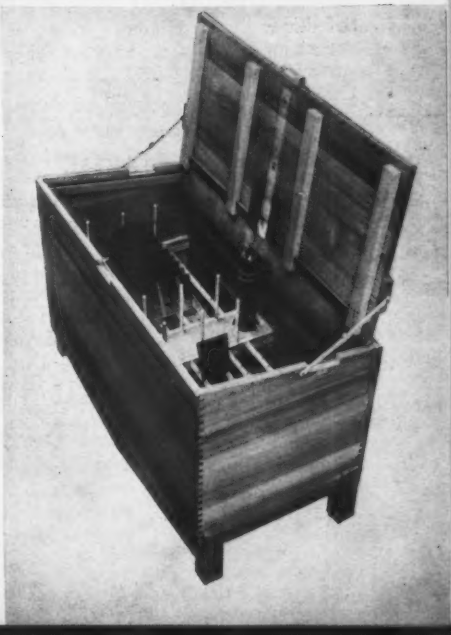
(Above) Pipe fittings such as this corrosion-resistant waste trap can be produced from "Welvic" p.v.c. paste, manufactured by I.C.I., Ltd., Plastics Division.



(Right) The flexible drive stirrer made by Townson and Mercer, Ltd., incorporates an all-plastics corrosion-resistant chuck to hold glass stirrers. The slotted body of the chuck takes sliding "Tufnol" jaws which are held by a synthetic rubber band.

(Left) This small laboratory at Guy's Hospital, London, is tiled with black and cream mottled plastics floor tiles manufactured by Thomas De La Rue and Co., Ltd.

(Right) The salt spray cabinet produced by Townson and Mercer, Ltd., for corrosion testing may not contain metal, so "Tufnol" is used for jet holders, threaded clamps, etc.



World's Industry Employs Plastics

GENERAL ENGINEERING

Resin/glass fibre mouldings.—C. D. Birmingham describes the low-pressure moulding of aircraft components from woven and matted glass fibre bonded with polyester styrene. Short runs of mouldings may be produced more economically than by conventional methods. ("Materials and Methods," 1951/Sept./79.)

Postformed plastics,—W. I. Beach compares the physical characteristics and applications of laminated plastics and different metals, fourth article. ("Machinery" (N.Y.), 1951/Sept./160.)

A plastics carburetter was made in the actual zinc die-casting mould by injecting methyl methacrylate polymers. The transparent plastics part was for visual inspection of the internal behaviour of the part in action. ("Materials and Methods," 1951/Sept./86.)

Phenolic resin for sand cores.—An improved liquid phenolic core-binder resin has been developed by General Electric Co., Chem. Div., to permit moulding of stronger cores. ("Materials and Methods," 1951/Sept./126.)

Avoiding blisters and depressions on injection mouldings.—F. Schaupp, in a communication of the Plastics Laboratory of Badische Anilin und Soda-Fabrik, gives recommendations how such difficulties can be avoided. These are mainly: Extension of the press-time, enlargement of the sprue cross-sections, increase in injection pressure. ("Kunststoffe," 1951/Aug./267.)

Moulding Technique.—The German Standards Institution has issued a standard (DIN 16 700, July, 1951) on definitions for different methods of processing plastics. A chart gives a survey of the whole field (Beuth-Vertrieb G.m.b.H., Berlin, W.15 and Cologne).

ELECTRICAL

X-Ray Illuminator.—An opal "Perspex" screen illuminated by cold cathode tubes provides uniform distribution of daylight-coloured light in the radiograph - viewing instrument manufactured by Watson and Sons (Electro-Medical), Ltd. ("Electrical Review," 1951/Oct./19.)

Improvements in fluorescent lamps.—A number of German plastics firms have developed new types of shades for fluorescent lamps. ("VDI-Zeits," 1951/Vol. 93/604.)

MISCELLANEOUS

A plastics magnifier (produced by the Alston Corp., P.O. Box 146, Hollydale, Calif.) of 12-in. length and H-shaped cross-section provides 2 × magnification for part lists, etc. ("Product Eng.," 1951/Sept./226.)

Pipelines of polyvinyl chloride.—The working committee on "Welding and Heat-treatment" of the plastics committee of "Kammer der Technik" (Technical Organization for East Germany) has prepared extensive recommendations for the laying and treatment of pipelines of polyvinyl chloride. ("Kunststoffe," 1951/Aug./247.)

Plastics sponge material.—In Russia a plastics sponge material, "Renoplast," has been developed for orthopædic shoes. ("Legk. Promysl (Moscow)," 1951/Vol. II, No. 6/41.)

Cast resin Hostacoll C is a resin which at room temperature or slightly above solidifies under the influence of a hardening agent, and which has found manifold applications. ("Kunststoffe," 1951/Aug./237.)

Rheological investigations.—J. Hegboer, of the Plastics Institute T.N.O., Netherlands, reports on the rheological properties of acrylates. (T.N.O. Nieuws, 1951/Aug./263.)

Climatical testing of plastics.—H. Hofmeyer discusses climatical testing of plastics in comparison with other materials, to determine their properties in practical use. This does not only refer to the testing of materials used in tropical countries. The terms of reference of the recently established working committee "Klimaprüfungen" are discussed. ("Kunststoffe," 1951/June/179.)

Degradation of polystyrene.—Films were exposed to heat at 100 degrees C. in a forced-draught air oven and to ultra-violet radiant energy at 60 degrees in air. Chemical structural changes were analyzed by studying the infra-red spectra. ("Journ. Research, Nat. Bur. Standards," 1951/pp. 116-125/Aug.)

Silicon resin pigment for clinical thermometers has proved to be durable and lasting. The new marking compound withstands cleansing with soap and phenol solutions far better than any other known pigment. (Nat. Bur. Standards, Technical News Bulletin, Vol. 35, 1951, p. 31.)

Internal stresses in injection-moulded polystyrene components.—H. Beck discusses three possible sources of stresses: (1) caused by rapid cooling, (2) through frozen molecular orientation, (3) caused by the shape of the article. He makes suggestions to overcome internal stresses. ("Kunststoffe," 1951/Sept./286.)

On the light sensitivity of organic films.—G. A. Schröter investigated the behaviour of organic film-producing substances, in particular of nitrocellulose and rubber hydrochloride. The structure and action of these substances is discussed. ("Kunststoffe," 1951/Sept./291.)

Moulded parts of polyamides.—A. Mueller shows that the actual application of the polyamides remains small in spite of their good properties; this may be due to the difficulty of moulding. It is shown that parts should only be produced by injection-moulding or machining. ("Kunststoffe," 1951/Sept./303.)

Production of combs from celluloid and thermoplastics.—P. Kandel gives a short survey of the production of combs by moulding, sawing and stamping. The injection moulding is also discussed. ("Kunststoffe," 1951/Sept./304.)

Competing with nature's hand.—C. A. McLaurin describes a new attempt to produce an artificial hand. Besides new mechanisms, the hand is moulded from the pattern of a human hand. The mechanism is enclosed in a resin-bonded glass cloth laminate, treated with polyesters or similar resins. The hand is covered with a cosmetic glove using an opaque and approximately flesh-coloured, or alternatively a nearly transparent, polyvinyl chloride/acetate. ("Mechanical Engineering," 1951/Sept./719.)

Porosity in plastics sheet materials.—A process has been devised to control the porosity of sheet material known as "electroventing." Electric sparks are passed through the sheet material to produce a specified size and distribution of holes. ("Mechanical Engineering," Vol. 73, 1951, p. 748, ASME Paper 51-SA2.)

Pipe connections for thermoplastic tubes.—H. Zickel describes a pipe connection using flanges; the preparation and making of the joint is described in detail. ("Kunststoffe," 1951/Sept./306.)

Elasticity of soft polymers.—C. A. Dahlquist and coll. report on their method of tensile testing soft polymers. ("Ind. Eng. Chemistry," 1951/June/1404.)

Solution polymerization of methyl methacrylate.—S. L. Kapur investigated the chain transfer in solution polymerization of methyl methacrylates. He studied the effects of solvents: benzene, chloroform, carbon tetrachloride and benzyl chloride. ("Journal of Scientific and Industr. Research," New Delhi, 1951/Aug./186.)

Utilization of Ultrasonics in the Plastic Industry—I

By W. S. PENN, B.Sc.

SOUND waves with high frequencies are important tools in modern industry and research. Their development on a practical scale commenced with World War I, but their application has not been as extensive as their valuable properties would suggest. Under the name of ultrasonics, however, these high-frequency waves are now being made use of in many branches of industry and the potentialities still seem to be very great.

Many industries are investigating the application of ultrasonics. Already in the plastics industry the phenomenon has been employed in the measurement of physical constants of plastics, in materials testing, in the emulsification of polymers, the depolymerization of polymers, and also in polymerization processes. The application of the same technique to both polymerization and depolymerization may seem anomalous, but under suitable conditions either process can be effected. These techniques are capable of great development and they are likely to be of some assistance, both in the manufacture and the testing of various products. It has been stated,[1] for instance, that the entire output of a tyre company has been examined for flaws by the use of ultrasonics.

In view of the undoubted value of high-frequency sound waves, it seems opportune to examine this subject as applied to plastics. Since the phenomenon is comparatively little-known, the present article will describe the principles involved in the use of the new technique as well as some of the applications in the plastics industry. Some indication of other properties of ultrasonics will also be given so that their potentialities can be fully appreciated.

Definition

Sound waves which are audible to human beings have a frequency range from about 20 cycles per second to about 20 kcs. per second. Vibrational or sound waves having frequencies above the latter value are defined as ultrasonic waves; these are inaudible to the human ear, but they have all the properties of audible sound waves.

The phenomenon of resonance whereby a piercing shrill note can shatter glass is well known. The action of ultrasonic waves is very similar to this except, of course, that the frequency of the waves is much greater, which means that there is a larger concentration of energy per unit area. The difference in the concentration of energy in this way between audible and high-frequency sound waves is the cause of the different effects which are obtained by their use.

Characteristics

It is necessary to know something of the characteristics of these ultrasonic waves before the reason for their application to any process can be appreciated. The density or intensity of the sound waves, as with any other type of radiation, may be defined as the energy passing through a unit area in a unit time. To give a simple comparison, at a distance of about 6 ft. from a trumpet, the sound intensity is only approximately 1/10,000,000 of a watt per sq. cm. To the human ear this is quite a deafening noise, but its energy is very small when compared with the fact that intensities of radiation of 50 to 5,000 watts per sq. cm. have been produced by some of the modern generators.

Another characteristic which must be investigated with all radiation is that of direction. Ordinary sound waves with low frequency will spread out from their source in all directions and consequently will bend around corners. This is related to the phenomenon, as with all radiation, whereby the directional nature of propagation is a function of the wavelength. Furthermore, the wavelength of a wave is universally proportional to the frequency, which means that a high frequency will give a short wavelength.

This means that the higher the frequency the shorter the wavelength, with a consequent change towards unidirectional properties of the radiation. In the case of high frequencies this becomes a truncated cone and waves of very high frequency are propagated with a negligible deviation in a given direction and with negligible bending.

To give an indication of the values which have been achieved, wavelengths in air of ultrasonic waves have reached those of visible red light. These waves have the directional properties of a beam of light, and to attain this condition a frequency of 500 megacycles has been achieved. One unfortunate characteristic of these beams of ultrasonic waves is that the attenuation of the radiation is proportional to the square of the frequency. This means that when an effort is made to transmit beams over long distances, sharp definition cannot be obtained. In spite of this, however, ultrasonic waves have been employed for submarine detection. An interesting account of the principle involved with ultrasonics has been given by A. R. Laufer.[1]

Development of Generators

Many attempts have been made in the past to develop suitable generators of ultrasonic waves. Some of the early attempts utilized forced air whistles, reaching a frequency of 25 kc. and tuning forks developing up to 90 kc., but these methods only gave a small power output and they could not be controlled as would be desired.

In 1915, ultrasonic vibrations were excited in a micro-condenser by a Poulson arc and this was fairly successful, enabling a transmission range of up to 2,000 yards. Shortly after this, however, the use of a vacuum tube oscillator and a piezo-electric crystal was developed and, with minor variations, this remains the method at the present time.

The action is, of course, the opposite to the piezo-electric effect, i.e. a high-frequency voltage is applied by means of electrodes to the opposite faces of suitable crystals. By adjusting the oscillator frequency to the natural resonance frequency of the crystal, powerful beams of ultrasonic waves result and pass through the medium surrounding the crystal. These waves can be controlled very accurately.

A later development of another type of generator involved the development of the magneto-striction oscillator. This employs a ferrous metal rod as the core of a solenoid which is energized by an alternating current. As a result of magneto-restriction, the rod changes its length periodically in the field and a beam of ultrasonic waves is radiated from the end of the rod. This method is used fairly extensively, but on the whole can only generate frequencies up to about 60 k.c. At greater frequencies than these, the piezo-electric generator is normally employed.

Effects of Ultrasonic Waves

Before proceeding to give a description of the use of ultrasonics in the plastics industry, it is interesting to note some of the effects which can be produced with these waves. These indicate in a very vivid manner the properties of the waves and some of the things which can be done with them.

If an oscillator is surrounded with transformer oil and the crystal excited, a mound of oil can be raised an inch or so above the normal level, and the oil appears to be in a state of violent agitation. Although a thermometer indicates very little rise in temperature, a finger immersed in the liquid

[1]All references will be given in the second part of this article.

experiences a considerable scalding pain. If a tapered glass rod is immersed in the oil, the vibrations are transmitted through the rod so that it will rapidly burn its way through wood. Glass plate can be drilled in a similar manner, and very rapidly, the glass being displaced in the form of fine powder or fused globules. It is interesting to note that the heat only occurs at the point of contact.

Biological cells of animal or vegetable tissues in contact with the oil are violently disrupted and many small living creatures are killed. Bacteria in milk, for instance, can be destroyed, thus enabling pasteurization to be carried out at low temperatures.

Uses in the Plastics Industry

Ultrasonic waves may be used for various purposes in the plastics industry. In the case of colloids, for instance, it is possible to produce true colloidal solutions and fine emulsions. This is due to the violent agitation which rapidly disperses solids or liquids in liquids. Thus, in the first instance, it is possible to produce emulsions for polymerization processes.

Secondly, it has been found that polymerization may be effected by the use of ultrasonic waves. This can be carried out in solution[2] or in emulsion form,[3] and it has definitely been shown that the induction period normally associated with many polymerization processes is considerably reduced. Conversely, degradation of high polymers can be readily effected by the use of ultrasonic waves,[4, 5] and it has been shown that a definite rupture of the chain occurs rather than any thixotropic effects.

Many properties of plastics can be measured by means of ultrasonic waves and as an extension of this, the relationships between structure and physical constants can be examined. Elastic properties,[6] mechanical properties,[7] and densities[8] have been studied, and very useful results are being obtained. A novel method of materials testing which has been developed[9] is of interest to all moulders and fabricators. It is possible by this technique to examine rapidly every article produced, and without destroying the article.

Materials Testing

The technique employed in materials testing by ultrasonics has certain advantages over X-ray testing. The application of the ultrasonic waves is based on a simple pulse technique. This may be used for the detection of flaws in metals, in plastics and in other high polymeric materials, such as rubber. As regards technique, the usual crystal is employed to transmit a short pulse of ultrasonic waves into the object under examination. The same crystal which is used as a generator is also employed to receive reflections of the primary pulse, and this is made possible by the normal piezo-electric effect. Output of the crystal is amplified and transmitted to the screen of a cathode-ray oscillograph. This depicts the primary and all reflected pulses and readily enables the presence and position of imperfections to be detected.

There are various advantages over X-ray equipment in carrying out this test, the most important being that greater depths of material can be penetrated and the equipment needed is more readily portable. A detailed account of the theory and application of ultrasonic vibrations to materials testing has been given by Valkenburg.[9, 10] The application of the waves to steel, glass and plastics is indicated.

Polymerization

It has already been stated that solution polymerization can be accelerated by the use of ultrasonic waves.[2] This also applies to bulk polymerization, the polymerization of acetic acid having been described.[11] It also applies to emulsion polymerization,[3] and as far as the emulsification itself is concerned, rate of dispersion, particle size and stability can be controlled.[12] Certain chemical reactions can be accelerated by means of ultrasonic waves.[13]

A detailed description has been given[3] of the methods employed for emulsion polymerization with ultrasonic vibration. In this particular work, two types of generators were employed, these being the magneto-striction type and the quartz oscillator.

In the case of the magneto-striction apparatus, the polymerization of a simple styrene formula was examined. This had the following composition.

Ingredients.	Parts by Weight
Styrene monomer	100.0
Distilled Water	180.0
Soap	55.0
Potassium persulphate	0.6

The apparatus consisted of a laminated nickel bar excited by a coil of 28 turns of $\frac{1}{8}$-in. copper tube, which carried water for cooling. Both a d.c. polarizing current and an a.c. current of about 15 to 20 amps. at 400 v. was employed and this set-up operated at 15 kc. The assembly was immersed in the emulsion of the styrene and the container was jacketed to enable the temperature of the liquid to be controlled.

Various modifications of the conditions were tried, and in each case a control batch was run with baths containing the oscillator but without current in the coils. Two batches of 600 and 1,200 c.c. were tried and the temperatures employed were 40 and 50 degrees C. It was shown that there was only a slight increase in the actual rate of the reaction, the percentage yield finally achieved being virtually the same in the case of the control and the experimental batch. However, the induction period was considerably reduced, the rate of formation of polystyrene being doubled.

To show that the polymerization was not solely due to the temperature rise, an aluminium rod was substituted for the nickel rod, and this was heated by eddy currents at the same temperature as that reached by the nickel rod during a run. Although the induction period was reduced by this method, it did not account for all the reduction in the induction period.

The magneto-striction apparatus is not an entirely satisfactory source of energy as previously described. Investigators therefore employed an X-cut quartz crystal, giving a source of energy at 500 kc.

Experiments were again carried out at 40 degrees and 50 degrees C., and more or less the same results were obtained. The induction period was reduced and it was roughly calculated that the reduction in time is approximately proportional to the power used. As an example of the effectiveness of the technique, at a rate of one watt per c.c., a 70 per cent. yield of polystyrene is obtained in 25 minutes at 50 degrees C.

In addition to the polymerization of styrene, the production of synthetic rubbers was examined. The emulsion polymerization of butadiene and styrene to GR-S by the normal method at 40 to 50 degrees C. was tried. Similar results were obtained in a formula for manufacturing cold rubber at 41 degrees F.

It has not yet been decided why the above effects are obtained. It has been suggested that cavitation is required, which means that the high instantaneous pressures and temperatures developed as a result of the collapse of the cavitation bubbles may be the cause of the effects (see later, under Degradation). It may also be that better emulsification results, which, it is known, reduces the induction period. It has also been noted that ultrasonic radiation increases the rate of oxidation and the production of peroxides. In the case of the persulphate catalyst, the increase may also be due to the increased rate of formation of free radicals.

Much more work has been carried out than that described, but a great deal still remains to be done. The mechanism of the reaction, for instance, is not fully understood and a great deal of work will have to be carried out in the future.

(To be continued)

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

Petrol Dispenser

Sir,—An Australian customer wants us to get in touch with the manufacturers of the "Syphonex" petrol dispenser. This is a small pump, mostly made of plastic material, which can be screwed on the top of a bottle containing petrol, enabling a small quantity to be pressed out for refilling lighters.

W. A. SPARROW AND CO., LTD.
Chiswell Street, London, E.C.1.

[EDITOR'S NOTE: The distributors of the "Syphonex" petrol dispenser are S. B. Weston Utilities, 1 and 3, Argyll Road, Teddington, Middlesex. The type of dispenser referred to is the same as that used on the "Ronsonol" bottle, which we illustrated in "Plastics," June, 1949, page 328. The head is of soft and hard p.v.c., and the tube is of polythene.]

Curtain Rail

SIR,—We believe we have seen in "Plastics" some reference to plastic curtain rail made by extrusion, or other methods. We should be obliged if you would let us know who makes this rail.

WHEWAY OPTICAL CO., LTD.
214-234 Barr Street,
Birmingham, 19.

[EDITOR'S NOTE: An illustration of rigid extruded curtain rail was included in our monthly feature "Plastics in the Service of Man" in October, 1949 (page 73); this "Rockite" extrusion is made by British Resin Products, Ltd., 21, St. James's Square, London, S.W.1. There is also available a flexible curtain rod made by extrusion, as supplied by Suflex, Ltd., 35, Baker Street, London, W.1.]

Floor Tiles

SIR,—Can you inform me of the addresses of firms engaged in the manufacture of p.v.c. or similar plastics floor tiles?

COLYERS, LTD.
222, High Street,
Cheltenham, Glos.

[EDITOR'S NOTE: Thomas De La Rue and Co., Ltd., 84-86, Regent Street, London, W.1; Hornflowa, Ltd., Maryport, Cumberland; Phœnix Rubber Co., Ltd., 91, Bishopsgate, E.C.2; Rubber Improvement, Ltd., Hythe Road, Willesden, N.W.10; Semtex, Ltd., 185, Finchley Road, N.W.3.]

Di-allyl Phthalate

SIR,—Please let us have the address of Technical Products, Ltd., who, we understand, are handling di-allyl phthalate in this country.

ALEXANDER FINLAY, LTD.
Soap, Candle and Glycerine Works,
Belfast.

[EDITOR'S NOTE: Technical Products, Ltd., have now been incorporated in Shell Chemicals, Ltd., 105-109, Strand, London, W.C.2. Details and sample quantities of di-allyl phthalate are available from this address. Similar types of polyester resins are made in this country by Scott, Bader and Co., Ltd., Wollaston, near Wellingborough, Northants, and I.C.I., Ltd., Plastics Division, Welwyn Garden City, Herts.]

Plastic Coil

Sir,—We are anxious to find a manufacturer of material similar to the enclosed. It is in the form of strip to produce a coiled "spring" with an internal diameter of 1 in. We understand this is a plastic.

CLEMESHA BROS. AND BIRCH, LTD.
Leek, Staffs.

[EDITOR'S NOTE: The strip is very heavily loaded with red pigment (iron oxide?) and is ¼ in. wide and 15/1000 in. thick. It contains chlorine, which may indicate a p.v.c. type unless a chlorinated plasticizer has been used. Cellulose acetate and celluloid strip has long been used for the purpose.]

Universal Joint

Sir,—Can you please oblige us by locating an advertiser in your journal who illustrated a spherical universal joint? This was constructed with a plastic ball carrying a transverse pin. Unfortunately our copy of the issue in question has been destroyed.

SMITH'S JACKING SYSTEMS, LTD.
Edgware Road,
London, N.W.2.

Transparent Packs

SIR,—We are interested in promoting a line of coffee packed in transparent plastic bags, but have as yet been unable to contact a guaranteed continuity of supplies of the necessary material. Can you assist us in this difficulty.

J. HAWORTH AND CO.
(TEA AND COFFEE), LTD.
12 and 14, Sugar Lane,
Manchester, 4.

Permanent Pleating

SIR,—We would much appreciate any technical data dealing with the treatment of fabrics with synthetic resin solution with relation to permanent pleating.

BERKER SPORTCRAFT, LTD.
Blenheim Street,
New Bond Street, W.1.

Small Flasks

SIR,—Could you kindly inform me of makers of small plastics flasks?

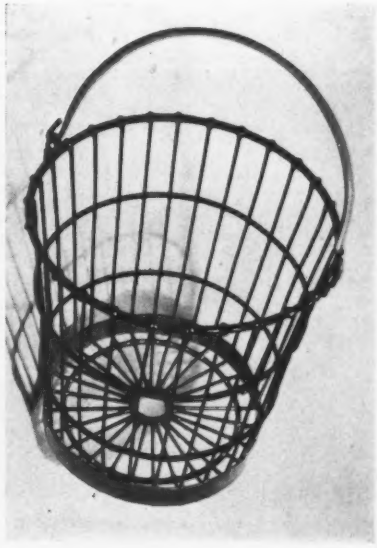
F. WHEATER.
11, Gordon Square,
Whitley Bay, Northumberland.

[EDITOR'S NOTE: Small bottles of various shapes are blown from polythene. They are made by Cascelloid, Ltd., 11, Southampton Row, W.C.1; E. Shipton and Co., Ltd., Northwood, Middx; Industrial Appliances, Ltd., 21, Grosvenor Street, W.1.]

Soft—the Egg Breaketh Not

THE use of highly plasticized p.v.c. is relatively so new that a knowledge of its properties cannot but prove of growing interest to a widening range of industries. That the movement has already begun, and strongly, can be gauged from the variety of products seen at recent exhibitions, such as industrial gloves, acid-resisting coatings for jigs, flexible couplings, etc. Of exceptional promise is the ease with which a metal can be dipped to receive a permanent thick, soft coating of p.v.c., so that not only is the metal protected against rust but also against physical damage due to impact.

An unusual application in which this principle is applied—and, indeed, it goes further in that the contents of the apparatus are also protected—is the wire basket in the accompanying photograph. These baskets are made for Curfew Appliances, Ltd., of Chertsey, Surrey, by Creators, Ltd., Silmay Works, Kings Road, New Haw, Weybridge, Surrey. They are to be used in conjunction with egg washing machines on poultry farms, for pre-soaking the eggs before they are washed. They enable the eggs to be taken direct from the nest, and until they are ready for dispatch this is the only time they need be touched by hand. The plastic prevents a large number of eggs being broken, and, in addition, particularly on pedigree poultry farms, careful check may be kept on the laying qualities of one group of birds as compared with another; different coloured baskets, therefore, are being used for the collection of their eggs. It will be noted that the handle and the remainder of the basket have been treated in different colours.



New Productions

Valve Plug

Polythene plugs are now used in some of the "Audco" valves made by the Audley Engineering Co., Ltd., Newport, Salop, for corrosive services. These particular valves, with a silicon-aluminium body, were developed to control the flow of chemical liquids which are handled in aluminium equipment. As it is impracticable to use an aluminium plug turning in an aluminium body, owing to the softness of the metal and its susceptibility to galling and seizing, a substitute material had to be found and polythene proved to be the most suitable. In all respects the valves concerned are identical with the Company's normal range of light standard type valves, except that a side feed lubrication system through the body is used instead of normal feed down the plug shank, as the latter method would detract too much from the strength of the polythene. A mild steel shank body is moulded into the polythene to give the necessary strength to the operating wrench. The maximum temperature of operation for these valves is limited to 60 degrees C., due to the softening tendency of the polythene at higher temperatures; maximum working pressure is 50 p.s.i. (test applied 100 p.s.i.).

Our illustration shows a 2-in. diameter plug, which is fully machined. Moulding for the Audley Engineering Co., Ltd., is done by Minerva Laboratories, of Cardiff. As regards the machining of the polythene, the valve makers inform us that standard carbide-tipped cutting tools are used, with machines and practice generally as for the machining of metal, but employing somewhat faster surface speeds and rather finer feeds.

Valve plug.

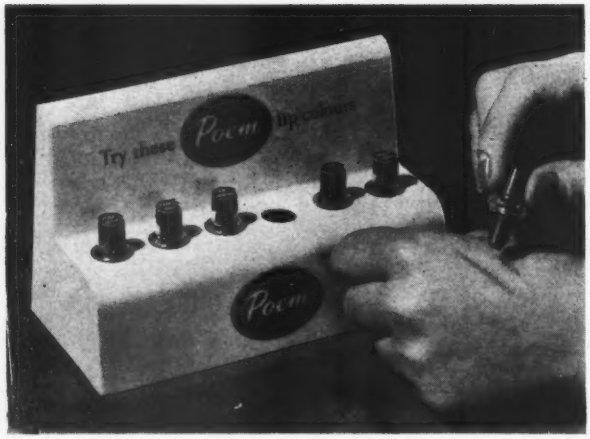
Novelty Key-Ring

The Rex Gem Co., Ltd., Mansfield Street, Leicester, have sent us a novelty in key-rings. The actual ring is of metal, but the appendage in the form of a miniature soda-water syphon, cast in acrylic resin has a life-like appearance, as will be seen from our photograph. The "bubbles" in the syphon could be produced by applying suction to a fairly viscous polymer.

Novelty key-ring.

Lipstick Sampler Unit

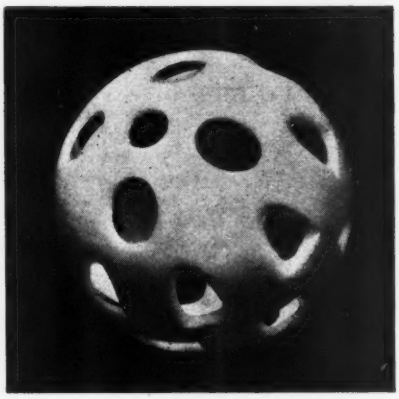
This counter-display sampler unit for "Poem" lipstick is moulded in "Beetle" and silk-screen printed (blue). The lipstick samples are housed head downwards by inserting them in holes in the moulding. Each lipstick has a holder with a flange to locate it in the main moulding. The individual holders, moulded in clear polystyrene, provide a clean and rigid base for handling the samples. Being transparent they also attractively display the colour range, whilst protecting the displayed portion of the lipstick. The name of each sample in the colour range is engraved and filled (white) on the base of the individual holders, and is visible when the holders are housed in the main moulding. Moulding and printing are by British Artid Plastics, Ltd., 261-2 Buckingham Avenue, Trading Estate, Slough, Bucks, for A. and F. Pears, Ltd. (Photo: courtesy British Industrial Plastics, Ltd.)



Lipstick sampler unit.

Practice Ball

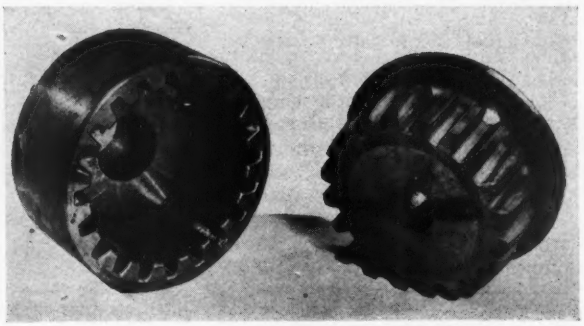
This "Gamster" ball, 2½ inches diameter, used in practice play at various games, is injection moulded in polythene in two halves which are cemented together. The makers are Abbey Corinthian Games Co., Greycoat Place Building, London, S.W.1.



Practice ball.

Pinion Coupling

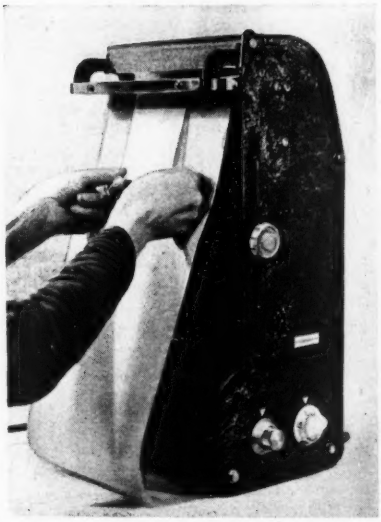
The pinion coupling which we illustrate is used on run-out table rollers at a hot strip mill. It was exhibited by Tufnol, Ltd., at the 1951 Engineering and Marine Exhibition. The coupling is of steel encased with "Tufnol" pinions, transmitting a load of 0.62 to 1.77 h.p. at 270 to 775 r.p.m. The teeth of the pinions are rounded to take the play on the spindle. Working conditions at hot strip mills are extremely poor, with water and dirt in abundance. Previously the average life of a pinion was under six months; since using "Tufnol" this period has been increased to twelve months or more.



Pinion coupling.

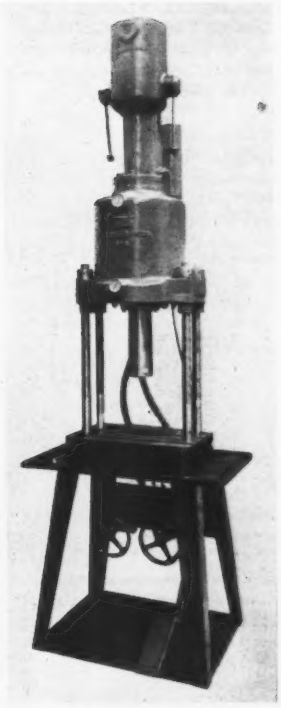
PRODUCTION NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes



"Autobond" heat sealer.

"Instron" tensile tester.



"Airdraulic" press for plastics sheet manipulation.

HEAT SEALER.—The "Autobond" sealer, a production of The D.C. Engineering Co., Ltd., Sherborne, Dorset, was primarily designed for heat-sealing "Alkathene." It can, however, also be used with "Pliofilm" and certain other types of heat sealable materials. It is known that "Alkathene" is not a particularly difficult material to seal, but the technique of sealing is somewhat complicated by the fact that the seal must be cooled before the film can be removed from the jaws of the orthodox type of heat sealing machine, and this operation considerably slows down the speed at which such machinery can be operated.

In the "Autobond" sealer an entirely new technique has been developed in so far as the material is sealed onto a continuous band of fabric which lies between the heating element and the "Alkathene." Pressure is provided by another jaw which is lined with "Fluon." After the seal has been effected the fabric is pulled away from the jaws in a downward movement, and the sealed material is adhered to it where it can be left to cool while the next seal is being made.

With this method a completely satisfactory seal is obtained at a working output of about 60 seals per minute. In actual fact it is possible to seal material 0.005 inch thick in half a second, but it is, of course, impossible to feed the machine at this rate.

Another distinct feature of the "Autobond" sealer is that while it is both temperature- and time-controlled, it is also pressure-controlled As soon as the material has been presented to the jaws for sealing, the merest touch of a foot-switch brings the machine into operation, and as soon as the seal has been completed, the jaws open automatically.

TENSILE TESTER.—Several new accessories have been added to the "Instron" tensile tester (Instron Engineering Corp., 2, Hancock Street, Quincy 71, Mass., U.S.A.), greatly increasing its versatility. This precision electronic testing instrument has found wide use in a great number of fields, among which are plastics and adhesives. Outstanding among its features is the wide full-scale range, extending from 2 grams to 5,000 lb. In addition, a selection of jaw speeds is provided, ranging from 0.02 to 20 ins. per minute. The combination of a versatile system for changing the load sensitivity and push-button switching for operating the moving crosshead, make possible fast routine measurements as well as complex testing techniques. The electronic load weighing system is based on the electric strain gauge principle to detect variations of load in the specimen under test. The motion of the lower jaw assures a constant rate of elongation in either direction and providing almost instant starting, stopping or reversing.

The addition of compression accessories extends the versatility of the "Instron" tester. An auxiliary and easily removable crosshead, as shown in the accompanying photograph, is attached to the frame below the moving crosshead. Compression-type load cells have a rigidly attached load sensitive table. The sample is compressed between this table and the moving crosshead. The same flexibility of control for operating the motion of the crosshead in tensile measurements is possible for compression testing. Load deformation, cyclic, and relaxation data, can be obtained with the same accuracy and high speed response.

PLASTIC SHEET MANIPULATION.—One of the most difficult problems in plastic sheet manipulation, such as forming and shearing, is to be able to control the speed of the process and also to have sufficient pressure to do the work without damaging the material. This also applies to the riveting of plastic details and the building up of unit components.

The range of "Airdraulic" presses made by E.M.B. Co., Ltd., Moor Street, West Bromwich, Staffs, gives infinite variation of speed and pressure from zero up to the maximum required. Both are independent of one another and can be repeated indefinitely without variation. These machines are available in 1-, 2-, 4- and 7-ton sizes, with controlled delayed action on the three larger sizes if required, as well as interlocked gate guards. "Airdraulic" presses are powered by compressed air from any supply line of between 50 and 100 lb. sq. in. pressure, the speed being controlled by a self-contained hydraulic system in the machine itself.

T. H. AND J. DANIELS, LTD., Stroud, Glos., have sent us their six-page leaflet on moulding plant for plastics and rubber. The illustrations include two tableting machines —No. 3 for tablets up to 2¾ ins. diameter (suitable for phenolic powders only), and No. 2B for tablets up to 1½ ins. diameter (suitable for most grades of urea and melamine, in addition to phenolic powders), capacities being 1,500 and 3,600 single tablets (based on standard phenolic powders) for machines No. 3 and No. 2B respectively. The range of moulding plant shown includes downstroke prefilling presses for rapid action, with gravity closing to save hydraulic power; single-acting upstroke presses for simple mouldings (with return cylinders fitted if a positive opening force is required); side ram presses for articles requiring vertically split moulds; and transfer presses for complex mouldings with inserts, or those having a thick section. The company also make hobbing presses in 500- and 1,000-ton sizes for the rapid production of multi-cavity moulds.

MOULDERS' PLANT CAPACITY.—The British Plastics Federation have given us their permission to publish the following summary of moulders' plant capacity for 1949 and 1950, based on the information collected annually by the Moulders' Group:—

	1949	1950
NUMBER OF MOULDERS		
Compression	114	100
Injection	74	69
COMPRESSION MOULDING CAPACITY		
Total number of presses	3,791	3,568
Total capacity of presses (tons)	298,609	290,273
Number of presses (according to capacity)		
Up to 25 tons	1,143	1,042
26 to 50 tons	863	779
51 to 100 tons	1,219	1,192
101 to 150 tons	280	264
151 to 200 tons	106	94
201 to 250 tons	55	68
251 to 300 tons	13	18
301 to 350 tons	46	48
351 to 400 tons	11	8
401 to 450 tons	2	3
451 to 500 tons	16	16
501 to 1,000 tons	27	22
1,001 to 1,500 tons	7	11
1,501 to 2,000 tons	3	3
INJECTION MOULDING CAPACITY		
Total number of presses	586	589
Total capacity of presses (oz.)	1,977	2,148
Number of presses (according to capacity)		
Up to ½ oz.	93	76
½ to 1 oz.	90	87
1 to 2 oz.	100	105
2 to 3 oz.	62	75
3 to 4 oz.	86	80
4 to 5 oz.	6	6
5 to 6 oz.	48	40
6 to 7 oz.	3	2
7 to 8 oz.	82	103
8 to 20 oz.	12	12
20 to 32 oz.	3	2
32 to 40 oz.	1	1

NEW THERMOPLASTIC.—R. H. Cole, and Co., Ltd., 2, Caxton Street, Westminster, S.W.1, announce the addition to their range of a new high impact co-polymer designated "Styron" 475. This interesting material is similar to polystyrene, but has an impact strength three to five times, and an elongation approximately ten times that of standard polystyrene. These two properties, coupled with good dimensional stability, low water absorption, excellent electrical properties, good chemical resistance and reasonable cost, make it suitable for a wide variety of applications.

"Styron" 475 is at present manufactured only in the United States of America by The Dow Chemical Co., Ltd., Midland. Michigan. It has met with an excellent reception for the moulding of large refrigerator parts, hardware items, houseware, toys and novelties. The supply to Britain has been restricted, due to production limitation and governmental control, but towards the middle of 1952, this material will be manufactured in Canada by Dow Chemical of Canada, Ltd., as a consequence of which all interested moulders in this country should be able to obtain adequate supplies. "Styron" is the trademark of Dow Chemical Company of Canada, Ltd.

STYRENE PRODUCTION.—It is announced that Forth Chemicals, Ltd., which is at present constructing a plant at Grangemouth for production of monomeric styrene, has decided to proceed at once with an expansion which will substantially increase the projected production of this material. Forth Chemicals, Ltd., was formed last year by British Petroleum Chemicals, Ltd., (jointly owned by Anglo-Iranian Oil Co., Ltd., and The Distillers Co., Ltd.), and Monsanto Chemicals, Ltd. One of the raw materials of monomeric styrene is ethylene, which will be supplied from the new cracking plant which has recently been commissioned by British Petroleum Chemicals, Ltd. Forth Chemicals expect the smaller plant to come into production next year, and the extension about two years later.

PHOTOGRAPHIC FILM BASE.—The Board of Trade announces that the Treasury have made an Order under Section 10 (5) of the Finance Act, 1926, exempting photographic film base (dutiable only by reason of containing cellulose acetate as an ingredient) from Key Industry Duty for the period beginning October 24, 1951, to February 19, 1952.

BRITISH MOULDED PLASTICS LTD. inform us that the arrangements under which Caledonian Plastics Ltd., 12, Renfield Street. Glasgow, C.2, acted as distributors in Scotland and Northern Ireland for the National Plastics group of companies have terminated. Pending reconsideration of the question of representation in Scotland and Northern Ireland, Mr. Robert Hudson, a member of the staff of British Moulded Plastics Ltd., who had been working with Caledonian Plastics Ltd. under the arrangements previously existing, will be acting as the company's representative. Mr. Hudson's address is: St. Cyr, Middlemuir Road, Kirkintilloch, Scotland. (Tel: Kirkintilloch 1760.)

ASHDOWNS, LTD.—An agreement between the Panelyte Division of the St. Regis Paper Company, U.S.A., and Ashdowns, Ltd., of St. Helens, Lancs, has been reached for the British company to manufacture the resin-bonded laminate known as "Panelyte." Similar agreements have been reached between the American company and Etablissements Drouet, of France, and Skanskaattefabriken A.B., of Sweden.

DERWENT PLASTICS, LTD., Stamford Bridge, York, inform us that they are building a new press shop and toolroom, which should be ready for production early in 1952.

R. H. COLE AND CO., LTD.—Mr. Peter Hugh Cole has been appointed to the Board of this company. Mr. Peter Cole is the eldest son of Mr. R. Hugh Cole, managing director, and has been actively engaged in the business since his demobilization from the R.A.F. at the end of the war.

STERLING MOULDING MATERIALS, LTD.—Instead of the usual day's outing to Blackpool or some other Northern resort, taken in lieu of the August Bank Holiday, Sterling Moulding Materials, Ltd., this year brought their factory foremen and main staff to London for a two-day outing. At the South Bank Exhibition, members of the party were intrigued to see the way in which resins and plastic materials were so widely employed.

SHELL PETROLEUM CO., LTD., inform us that their Chemical Industry Management Department is now accommodated in St. Swithin's House, St. Swithin's Lane, E.C.4. (Telephone: Avenue 7144.) Correspondence, however, should still be addressed to St. Helen's Court, London, E.C.3.

MR. J. C. SWALLOW has been appointed chairman of I.C.I. Plastics Division in succession to Mr. P. C. Allen, who becomes a member of the I.C.I. Board and group director responsible for the Plastics, Paints, and Leathercloth Divisions. The new chairman was formerly Joint Managing Director. Before coming to the Plastics Division in 1942 as research director, Mr. Swallow was research manager of I.C.I.'s Alkali Division, where the research work leading to the discovery and manufacture of polythene was carried out.

DR. J. E. SISSON has been appointed Joint Managing Director of the I.C.I. Plastics Division. Dr. Sisson became delegate director responsible for sales in May, 1949. Prior to that he was sales manager in the Plastics Department of I.C.I.'s Southern Region Sales Office for two years. He joined I.C.I. in 1933 as technical officer at Billingham, subsequently becoming works manager at the "Mouldrite" factory at Croydon, and in May, 1943, manager of Home Sales Control Department, Welwyn Garden City.

BRITISH PLASTICS EXHIBITION AND CONVENTION, 1953.—To meet the wishes of an overwhelming majority of those who took part in the first British Plastics Exhibition and Convention, at Olympia, London, in June, 1951, it has been decided to hold a similar Exhibition and Convention in 1953, the exact dates to be announced later. The Exhibition and Convention will again have the full support and co-operation of the British Plastics Federation. Organizers are "British Plastics," Associated Iliffe Press, Dorset House, Stamford Street, London, S.E.1.

Private Account Imports of Moulding Powders.—(Board of Trade: Plastics' Materials Section)

	Licences issued July, 1951		Licences issued August, 1951		Arrivals July, 1951		Arrivals August, 1951	
	tons	£	tons	£	tons	£	tons	£
Cellulose acetate butyrate (U.S.A.)	3.15	1,559	8.3	4,725	2.4	1,228	74.25	35,980
Cellulose acetate butyrate (Germany)	—	—	—	—	—	—	—	—
Polystyrene (U.S.A.)	101.35	32,346	0.9	207	—	—	59.3	15,391
Polystyrene (Canada)	120.45	35,739	9.95	2,574	119.45	28,022	118.35	28,616
Polystyrene (Germany)	—	—	—	—	—	—	—	—
Cellulose Acetate (France)	—	—	—	—	—	—	0.05	14*
Phenol and Cresol formaldehyde (Germany)	—	—	—	—	—	—	15	4,881*
Phenol formaldehyde (France)	—	—	—	—	—	—	112.2	25,340*
Totals	224.95	69,644	19.15	7,506	121.85	29,250	379.15	110,222

* Open General Licence. All values given F.O.B.

WILLIAM PALFREY, LTD., and William Palfrey (Jute), Ltd., 66A, Fenchurch Street, London, E.C.3, notify us of a change of address to Palfrey House, 24, City Road, London, E.C.1. (Telephone: Monarch 0681.)

W. AND J. GEORGE AND BECKER, LTD., laboratory furnishers, have changed their address to Nivoc House, Ealing Road, Alperton, Wembley, Middx. (Telephone: Perivale 3344.)

ECKERT AND ZIEGLER, G.m.b.H., Weissenburg, Bavaria, founded in 1926 for the purpose of manufacturing injection-moulding machines and moulds for thermoplastics, are celebrating their 25th anniversary. They were the first company to build a horizontal-type injection-moulding machine. Up to that time, only vertical-type machines were known, and mostly the machines were built for the manufacturers' own use (for example by Gebrüder Eckert, Darragon-France, Buchholz-Berlin). They were also the first in the world to manufacture injection-moulding machines in series.

In 1930, Eckert and Ziegler exhibited the first injection-moulding machine in England under the name of their English agents, Hughes and Co., Ltd. At that time they supplied injection machines to the U.S.A. and Canada, thus introducing the injection moulding of thermoplastics to these countries. From 1930 to 1935, injection machines were supplied to almost all European countries. During the 25 years since their foundation the company has built about 1,800 injection machines, thus adding a remarkable contribution to the development of the injection-moulding industry. They were the initiators of many moulded articles, such as tube and bottle closures, combs and tooth-brush handles. In 1937 they developed a water hydraulic system for the operation of their machines to take the place of the air-operated set-up.

M. AND I. FIRE BRIGADE.—Competing against 31 teams at the Annual Tournament of the London Private Fire Brigades' Association, held on Saturday, September 29, at the works of Standard Telephones and Cables, Ltd., New Southgate, the Works Fire Brigade of The Micanite and Insulators Co., Ltd., Walthamstow, E.17, won for the second time in succession the trophies for the Championship of the United Kingdom and the 1st Division Championship. They were also awarded the Hitchcock Shield for the two-man drill and the Achille Serre Cup for the five-man drill. The team included S/L J. Beech, S/L G. White, L/Fm. D. Cripps, Fm. A. Chamberlain, Fm. R. Patterson, Chief Officer F. H. Turner and Second Officer G. Dart.

An Educational Collection of Plastics

THE Plastics Research Institute T.N.O. at Delft, Holland, in co-operation with the Federation of Netherlands Plastics Manufacturers, many Dutch plastics companies, and the Association of Physics and Chemistry Masters, has recently prepared a special collection of plastics samples and applications for educational purposes.

These collections, to the number of 100, each packed in a white varnished wooden box, were offered to the Ministry of Education, Arts and Sciences for distribution among the secondary schools in Holland. Each box contains seven small bottles with samples of moulding-powders, viz., phenol-formaldehyde, polyvinyl chloride, polystyrene, cellulose acetate, polythene and polymethyl methacrylate. In addition, there are 54 samples of finished plastics products, manufactured by various techniques, such as compression moulding, injection moulding, extrusion, calendering, deep-drawing, and dipping.

The collection of samples outlines the manufacture of acrylics, casein plastics, cellulose plastics, di-allyl phthalate, melamine-formaldehyde, polythene, polystyrene, urea-formaldehyde, vinyl derivates, nylon and phenol-formaldehyde, and various processing techniques. The samples are labelled to give an indication of appropriate applications. A separate list shows the raw materials from which the samples have been manufactured.

Machines for the Industry

The E.M.B. No. 9 Injection Moulder

The injection moulding machine described in the present article is made by E.M.B. Co., Ltd., West Bromwich, Staffs. Its plasticizing capacity is 4 oz. per shot.

THE E.M.B. No. 9 injection moulder will produce a generous 4-oz. moulding in cellulose acetate, polystyrene and similar plastics, the cylinder giving an injection pressure of 7.6 tons per sq. in. A high pressure cylinder is available for moulding materials such as some types of poly methyl methacrylate and hard p.v.c., which require a higher pressure.

The main idea of the machine is to mould the most economical weight of plastics with the operation reduced to the simplest possible procedure and with maintenance within the scope of the average engineer. Specialist mechanics are not necessary. Particular attention is paid to the design of the cylinder and the method of heat control. The heating surface is very large and is subdivided into zones, the heat input to each being under separate control.

Two types of operation are available. A single-handle control, in which the whole of the operation of the machine is controlled by one lever with a timed injection device, and the automatic control, which will give either single cycle operation or a complete automatic or continuous cycle.

The machine takes compressed air at 150 lb. per sq. in. maximum. This pressure can be reduced by valves built into the machine to give complete variation of the injection pressure, locking pressure and various return pressures.

Injection Head

The air cylinder (1), Fig. 1, gives 21 tons injection pressure through a stroke of 9½ ins. This cylinder is chromium-plated and honed to give the maximum life to the packings. These packings, and other packings and seals on the machine, are of special E.M.B. design and manufacture, which have been developed over the past 30 years of continuous development in pneumatic machinery.

Admission of air is controlled by a quick-acting valve mounted at the back of the machine and operated by remote control from the control box on the locking head. These remote control circuits are all pneumatic and are extremely reliable due to the large amount of power that can be obtained from a small air cylinder. The actual control of the air in the valve is by means of synthetic rubber-faced poppet valves, easily removable for checking and very reliable in operation. Samples of these valves have been run for over a million operations with no appreciable wear.

The movement of the injection ram is controlled by the hydraulic speed control (2), which is designed to give the plunger the maximum economical speed for moulding with smooth movement and a steady withdrawal of the plunger after completion of the injection stroke.

The feed hopper (3) is of ample size, with a visible indicator and provisions for cutting off the powder and cleaning out when changing to another colour. A very reliable compensating feed device controls the amount of powder delivered to the cylinder after each shot. This consists of a piston with annular grooves which picks up the correct quantity of

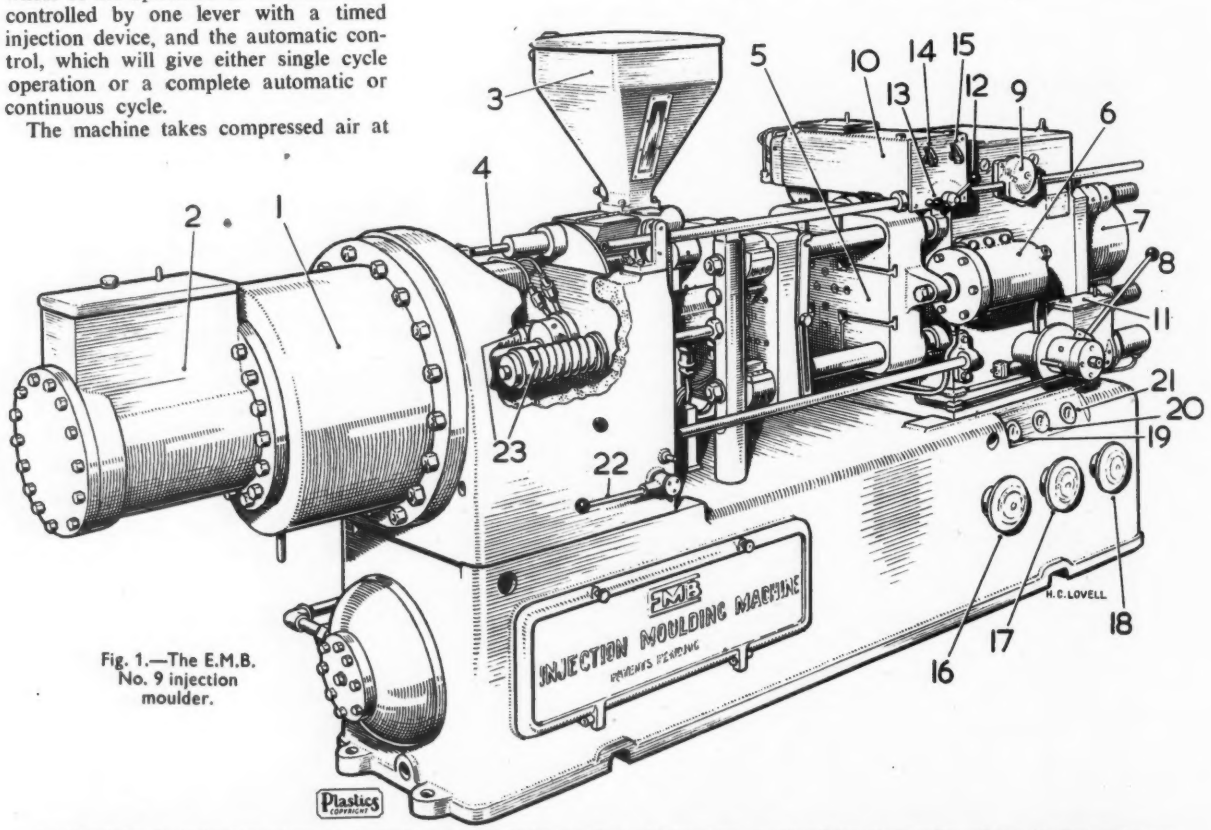


Fig. 1.—The E.M.B. No. 9 injection moulder.

1.—Air cylinder. 2.—Hydraulic speed control. 3.—Feed hopper. 4.—Graduated scale. 5.—Moving platen. 6.—Air cylinder. 7.—Intensifier cylinder. 8.—Single-cycle lever. 9.—Interlock on oil cam shaft. 10.—Timing unit. 11.—Air motor. 12.—Automatic lever. 13.—Knob for continuous working. 14, 15.—Pointers (control of injection time and cooling time). 16, 17, 18.—Dials (pressure control of injection, lock and return). 19, 20, 21.—Pressure gauges. 22.—Auxiliary lever. 23.—Springs.

powder, depending upon the position of the plunger at the end of the stroke. The grooves prevent inaccuracy of feed due to the powder spilling into the cylinder. The weight to be moulded is controlled by stops on a graduated scale (4).

The heating cylinder is the ideal shape, that is, it is long relative to its diameter, which combines a big heating surface with relatively thin walls. This, in combination with the use of the five heating zones (24) (25) (26) (27) and (28), shown in Fig. 2, enables an accurate control of the plastic to be maintained through the length of the cylinder, as the heaters are in close proximity to the plastic. This is most important as it is found that the heat input required in the different zones varies considerably. If even plasticizing is to be obtained without overheating it must be possible to use a great heat input in the rear heater, less in the rear centre heater with negligible heat input in the centre, as when the material reaches this zone of the cylinder the heat input has been sufficient to plasticize the material, but an accurate temperature must be maintained to give even heating through the plastic.

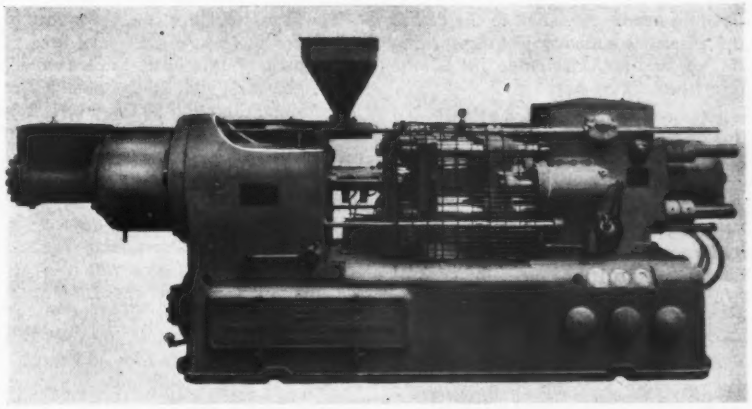


Fig. 4.—General view of E.M.B. No. 9 injection moulder.

24, 25, 26, 27, 28—Heating zones. 29—Thermocouples. 30—Spreader. 31, 32—Oil valves. 33—Cam. 34—Levers.

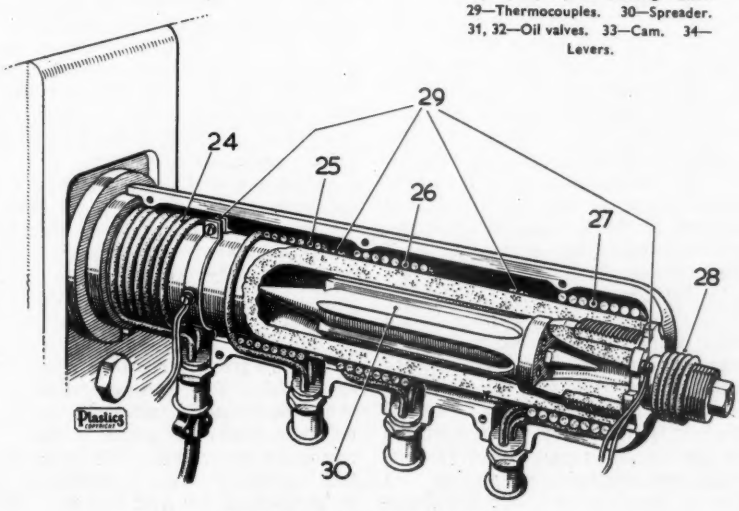


Fig. 2.—Details of heating cylinder.

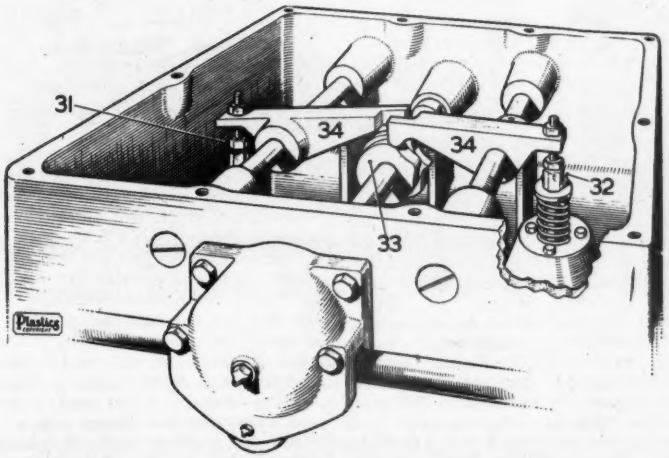


Fig. 3.—Details of valves in locking head.

This concentration of controlled heat is applied right up to the nozzle, and the temperature is indicated at four different positions in the cylinder by means of thermocouples (29) clamped to the wall. The spreader (30) is of a simple streamlined type, heated by conduction from the cylinder walls. As the thermal conductivity of the steel is some hundreds of times that of plastic, ample heat is conducted through the splines in contact with the cylinder to keep the spreader at the correct temperature. No internal heater is necessary in the spreader, thus cutting out a great source of maintenance troubles.

Referring to Fig. 1 again, taper sealing faces on the nozzle adaptor and the nozzle prevent leakage of plastic. The nozzle is of the flat-faced type and always in contact with the die. Under the action of the two springs (23) the nozzle is kept closely pressed to the die with sufficient pressure to prevent leakage. This prevents any dribble of hot plastic from the nozzle during operation of the machine. The sealing of the plastic in the end of the nozzle is by temperature control, using a heated nozzle in the end of the cylinder and water cooling of the sprue bush in the die. This causes a half solid block of plastic to form in the end of the nozzle which effectively prevents any leakage. A sprue well is provided opposite the centre ejector pin.

Occasionally it is necessary to operate the injection ram independently with the platens open, such as changing the colour of the material in the cylinder or double feeding making an oversize moulding. This is carried out by the auxiliary handle (22) on the injection head.

Locking Head

The moving platen (5) is moved backwards and forwards by means of two air cylinders (6), one on each side of

the locking head. Attached to the centre of the platen is a heavy piston working inside an hydraulic cylinder inside the body of the locking head.

A poppet valve is provided at each end of this cylinder to control the flow of the oil into each end of the cylinder. By controlling the air to the side cylinders to give the motive power and the opening and closing of the two poppet valves any desired movement of the platen can be obtained. As shown in Fig. 3, the control box for the air valves is mounted on the back of the machine and the two oil valves (31) (32) are actuated by means of the cam (33) through the levers (34) in the oil reservoir over the main hydraulic cylinder.

Referring to Fig. 1 again, when the platen is closed the oil pressure on the head of the hydraulic piston is increased by means of the intensifier cylinder (7), to give a total lock of 136 tons on the platen. The operation of the whole machine is controlled by the single lever (8). This directly operates the air valves in the valve unit on the back of the locking head through hardened cams, and controls the movement of the oil valves by chain drive on the back of the locking head. A remote control valve in the valve box operates the injection cylinder, thus the whole of the movement of the machine depends upon the rotating of a single cross shaft in the locking head. This cross shaft is interlocked with a sliding interlock rod attached to the moving platen (5) by suitably arranging the shape of the cams on this rod. It is impossible to apply the lock before the dies are closed or inject the plastic before the lock is applied.

Another interlock (9) on the oil cam shaft prevents the platens being closed until the dies are completely protected by the sliding guard, thus all the interlock depends upon direct mechanical means which cannot fail.

The simplest type of operation provided is by the single cycle lever (8). Movement of this lever towards the left closes the dies, that is the platen moves in the same direction as the lever. When the dies are closed further movement of the lever applies the lock, and continued movement operates the injection stroke. The injection stroke is controlled by a delayed action device which holds the lever in the injection position for a predetermined time which is set by the operator. After the moulding is complete the lever is brought back to the central position and moved to the right which opens the dies and ejects the work.

Automatic operation of the machine can be provided when required. This consists of two units, the timing unit (10) and the air motor (11). With this attachment the machine can be worked completely by hand from the lever (8). When required, this lever is pushed into the automatic position which disconnects it from the operating mechanism. The machine is now controlled by the automatic lever (12). When it is pushed to the right the dies close and the machine goes through its complete cycle and stops when the work is ejected. If the knob (13) is pulled out the machine will work continuously. Variation of the injection time and the cooling time is controlled by the two pointers (14) and (15). This sequence of operation is carried out completely by compressed air. The timing is by compressed air operated hydraulic dashpots which operate remote control poppet valves on the back of the automatic unit (10). These valves work the machine by means of the air motor (11), which is again speed controlled hydraulically. At any position of the cycle the automatic control can be completely disconnected by pulling the operating lever (8) back into the single-cycle or hand-operated position.

All the valves are mounted on the back of the machine and are easily accessible. It is only necessary to turn off the air to carry out any maintenance on the air system. The controls are carried through to the front of the machine to be close to the operator's working position. Thus the pressure controls for the injection, the lock and the return are controlled by the three dials (16) (17) (18) on the front of the machine, showing the pressure gauges (19) (20) (21), but the valves are on the back of the machine operated directly by shafts.

All the air cylinders are chromium plated and honed, and lubricated by spray lubricators in the air line. This system of lubrication has been in use on E.M.B. machines for 20 years and has proved most efficient.

Temperature Control Panel

The equipment for accurate control of the temperature of the cylinder is all carried in a separately mounted control pillar. The temperature of the different zones of the cylinder is shown on the indicator by rotating the pointer immediately underneath the dial. Dials control the heat input to the different zones of the cylinder, while the whole arrangement is automatically controlled by a two stage temperature controller.

When the heat is first switched on, maximum heat is applied to all zones of the cylinder, a red light on the panel showing that the machine is not ready for operation. When the temperature reaches within 10 degrees of the setting, the instrument automatically changes over to the settings of the zone heaters, and the light changes to green to show that the heat is approaching the working temperature. When the setting is reached the heat is cut off from the three centre heaters, the remaining heaters being left on to maintain correct working temperature and to compensate for heat loss by conduction to the machine.

Forthcoming Meetings

Nov. 16.—"Laminates—With Particular Reference to Electrical Testing," by R. A. Bettridge, B.Sc., A.R.I.C. (Tufnol, Ltd.). Plastics Institute, Midlands Section. At James Watt Memorial Institute, Great Charles Street, Birmingham.

Nov. 21.—A Paper by Professor P. D. Ritchie, B.Sc., Ph.D., F.R.I.C. Plastics Institute, North-Eastern Section.

Nov. 21.—"Fibreglass and the Plastics Industry," by A. M. Dobson, B.Sc., A.Inst.P. (Fibreglass, Ltd.). Plastics Institute, Southern Section.

Nov. 24.—Morning visit to Newcastle Breweries (limited to 20 members). Plastics Institute, North-Eastern Section.

Nov. 30.—"A Survey of Polystyrene Development." N. G. H. Thomas (Monsanto Chemicals, Ltd.). Plastics Institute, North-Western Section. The Engineer's Club, Albert Square, Manchester. 6.45 p.m.

Dec. 5.—"Regenerated Cellulose Film," by H. J. Ward (British Cellophane, Ltd.). Plastics Institute, Western Section. Grand Hotel, Bristol.

Dec. 5 and 6.—Film meetings. Showing of Documentary Films. Plastics Institute, London Section. Gaumont-British Theatre, Film House, Wardour Street, London, W.1.

Dec. 12.—Film evening. "Pattern for Progress," by Richard, Thomas and Baldwins, Ltd. "P.V.C. Film," by I.C.I., Ltd. (Plastics Division). Plastics Institute, Yorkshire Section. St. Mark's House, 186, Woodhouse Lane, Leeds, 2.

Dec. 12.—"Plastics in Packaging." F. A. Paine, B.Sc., A.R.I.C. Plastics Institute, Scottish Section. Institute of Engineers and Shipbuilders in Scotland, 7.30 p.m.

Dec. 19.—"Recent Developments of Unsaturated Polyester Resins." E. Bader (Scott, Bader and Co., Ltd.). Plastics Institute, Southern Section.

Horners' Awards

The British Plastics Federation have announced the presentation of the Worshipful Company of Horners' 1951 Awards for the design of an article made wholly or mainly in plastics. The Horners' Awards sub-committee of the Federation have recommended an award of £50 for the 1951 competition to be made to Mr. A. H. Woodfull, M.S.I.A. (British Industrial Plastics, Ltd.).

The winning design was for a baby's high chair. A second prize of £15 was awarded to Mr. J. T. Maddison (Bakelite, Ltd.) for the design of a heater incorporating heating elements in plastics panels. Altogether, eight entries were sent in for this year's competition. Other designs included a shaving compact, a bath rack, a desk tidy, and nursery bedside lamps; also a "hinged frame for holding sheets of standard size paper." A description of the winning entries will be given in "Plastics" next month.

New British Standards for P.V.C.

FOUR new British Standards, published recently by the British Standards Institution, are summarized below:—

FLEXIBLE POLYVINYL CHLORIDE FILM AND SHEETING (UNSUPPORTED) (B.S.1763: 1951).

This new British Standard applies to flexible p.v.c. film and sheeting (unsupported) for general purposes in plain (unprinted) and printed types. For the unprinted material it is specified that such sheeting shall be manufactured from a polymer of vinyl chloride or a co-polymer, the major constituent of which is vinyl chloride, with nominal thickness in the range of 0.004 to 0.015 in.

Control tests for unprinted material cover visual examination, thickness, tensile strength and elongation, tear strength and internal strain; type tests, the results of which are chiefly dependent on the basic formulation of the material, relate to blocking (adhesion of contiguous layers), extensibility after heat ageing, low-temperature extensibility, bleeding, and fastness to daylight exposure.

Thickness shall not differ from nominal by more than plus or minus 10 per cent. Longitudinal and transverse strength shall not be less than 2,000 lb./sq. in., and longitudinal and transverse elongation at break not less than 200 per cent. Tear strength in the longitudinal and transverse directions shall not be less than 250 lb./sq. in. thickness in each direction. Transverse tensile strength shall not differ from longitudinal tensile strength by more than 25 per cent. of the lower value, and corresponding elongations at break shall not differ by more than 30 per cent. of the lower value. The extension at a temperature of 20 degrees C. after heat ageing shall not be less than 50 per cent.; extension at −5 degrees C. not less than 10 per cent.

Control tests for printed material cover visual examination, blocking, adhesion of print, and bleeding; type tests concern fastness to light only.

Appendices printed in the Standard give precise details for carrying out the separate tests. For example, in testing for colour bleeding the test piece (2 ins. square) is placed on top of a 3-in. square control sample of clear transparent p.v.c. sheeting of the following formulation: polyvinyl chloride 100, diethylhexyl phthalate 66.6, lead stearate 1.5, cadmium stearate 1.5 parts by weight. The assembly is then covered with a dry Whatman filter paper or equivalent grade, and the layers brought into good contact, preferably by rolling. With a weight of approximately 50 gm. placed on top to ensure good contact, between test pieces and controls, the combination is placed in an oven and heated for 72 hours at 50 degrees C. plus or minus 1 degree. Control sample and filter paper are then examined for stains.

RAINWEAR FROM P.V.C. SHEETING, PART I, FABRICATION (B.S. 1774:1951).

This British Standard covers details of the manufacture of rainwear, including such matters as fasteners, attachment of pockets, flaps, button-holes, etc. It also lays down minimum requirements for the sewing thread to be used, as well as the types of seams to be employed. It is hoped shortly to issue Part 2, which will deal with the sizing of rainwear from p.v.c. sheeting.

FABRICATION OF LIGHTWEIGHT ARTICLES OTHER THAN RAINWEAR FROM POLYVINYL CHLORIDE SHEETING (B.S. 1776: 1951).

This British Standard covers details of the manufacture of lightweight articles such as aprons, babies' pants, sponge bags, toilet bags and similar fancy articles, together with tablecloths and table coverings. It also includes details of the fabrication, as well as such matters as fasteners, attachment of pockets, seams, etc. Furthermore, it lays down minimum requirements for the sewing thread to be used, as well as the types of seams to be employed. Tests are included for the strength of the sewing thread as well as of the seams.

GROMMETS FOR GENERAL PURPOSES (RUBBER AND RUBBER-LIKE MATERIALS) (B.S. 1767:1951).

This Standard deals with grommets for general purposes made of rubber and rubber-like materials for use in various industries, such as automobile, electrical, telecommunications and engineering. No attempt has been made to specify all the materials from which grommets can be made, as it is realized that materials may be developed in the near future which may be satisfactory in every way. Attention has, therefore, been confined to the natural rubbers and synthetic rubbers and rubber-like materials.

Minimum physical test requirements are laid down, together with some additional tests to meet special requirements. A table of dimensions for a standard range of grommets from ¼ in. up to and including 3 ins. is included. An appendix has been included setting out a suitable method for testing the resistance to exposure cracking of rubber and synthetic rubber grommets.

Copies of the above British Standards may be obtained from the British Standards Institution, Sales Department, 24 Victoria Street, London, S.W.1, price 3s. each, post free, for B.S. 1763 and 1776, and 2s. each, post free, for B.S. 1767 and 1774.

Terms Used in Plastics Industry

The British Standards Institution have also published B.S. 1755, "Glossary of Terms Used in the Plastics Industry" (6s. post free). This is one of the documents in the series which is being prepared to cover glossaries of terms used in various industries, and it is hoped that it will provide for greater uniformity and precision in the use of terms. The document is of considerable importance, as it will form a basis for discussions on an international level by Technical Committee 61 (Plastics) of the International Organization for Standardization.

Novelty in Car Display Model

To show the structure and some of the mechanism of the 1952 Hillman Minx car, the Rootes Group introduced an interesting new display model at the recent Motor Show.

What appears to be an ordinary saloon car with a black cellulose finish is suddenly illuminated from the inside, transforming the model into a skeleton car with transparent panels. This effect has been made possible by the particular light-reflecting and light-transmitting properties of dark-tinted transparent "Perspex" (shade: Neutral 905) made by I.C.I., Ltd., Plastics Division. This novel idea originated with Mr. Geoffrey Rootes, and was developed in co-operation with the Triplex Safety Glass Co., Ltd., who made and fitted the "Perspex" panels. Using a complete set of steel pressings of the metal car body as tools, the plastics panels were hand-moulded and fitted on to the prepared chassis and frame. The concentrated interior lighting required to realize the "X-ray" effect was installed by Pearce Signs, Ltd. Our photographs show the model car as it appears in its "normal" form (left) and transparent (right).

Successful Designing for Plastics Moulding—XXVI

By W. M. HALLIDAY

This instalment treats of component design as influenced by the provision of inserts, especially metallic inserts. Unless otherwise stated in the accompanying text, the illustrations may be considered as equally applicable for both compression and injection moulded articles.

AS a general rule, the adoption of inserts of almost any type and material will entail some diminution in the speed of operation of the mould. This, in turn, will have an effect upon production costs and the cost per article produced.

It is customary to load inserts into the mould by manual means, employing either a special loose loading plate, carrying a number of such parts, or by introducing each individual insert member into its proper location in the cavity area. Therefore, when considering the feasibility and possible economy to be derived from use of such features, a careful balance must be made between the added costs due to such slow manipulation of the mould and its subsequent working, and the ascertainable savings ensured in respect of machining, fitting, assembling and similar secondary operations, which may be reduced or even totally eliminated by employing the inserts. On the other hand, no such savings may be assured, but still the use of inserts may be found advisable to attain some other features not readily or economically possible from a straight moulding.

The insert itself should be of a form and size capable of being produced economically by ordinary moulding or machining methods. Any insert piece must be located and retained in the mould cavity in the most positive manner to avoid its disturbance due to the flowing pressures and turbulence of the plastics material.

This will involve the provision of certain additional features, such as support-pins, recesses, sliding-pins, springs, etc., within the mould cavity. For best results these items should be situated in the most accessible positions to facilitate manual loading, and, moreover, if such supports are in the for of detachable pins, they must be substantially mounted to obviate deflection.

The insert has also to be properly anchored or secured within the wall of the component. Whilst to a certain extent the normal shrinkage of the plastics material will exert a degree of gripping pressure in the insert, ordinarily this will prove insufficient to meet most industrial purposes

To avoid accidental disturbance of the insert member during use of the article, the exterior of the insert must be fashioned in a particular manner. Where the insert is in the form of a bushing having a threaded hole, into which some extraneous member such as a screw has to be threaded, two forces will act upon the embedded insert, tending to disturb its setting. Thus the insert should be securely anchored to prevent accidental rotation and lateral movement out of the wall. Various methods are adopted to guard against such occurrences and these will be illustrated later.

It will also be essential to ensure that the selected insert can be fashioned on its critical dimensions, i.e., outside diameter, overall length and bore, with sufficiently close accuracy to permit its correct and safe introduction into the mould cavity housing, etc.

A plastics moulded article cannot be more accurate than the inserts employed therein, and any initial errors present with such members, when added to the unavoidable deviations taking place on the moulding itself, may produce a scale of inaccuracy beyond permissible limits.

Considerable attention will also have to be devoted to the sizing and shape of the wall surrounding the insert employed in either a compression or an injection moulding. Plastics material, upon cooling and solidification in the mould, will contract a greater amount per inch of dimension than the metal of the mould or insert. Thus, excessively thin surrounding walls about a metal insert may thereby be cracked, or distorted considerably from their proper shape or size purely by the greater shrinkage occurring with the moulding materials.

To give best results and greatest safety in the manipulation and mounting of inserts into the mould, and to promote close accuracy and neater finished appearance in the moulded article, inserts should always be scrupulously inspected and cleaned before admittance to the mould.

Very often machined articles have certain tooling fins, or flashing, and may also have residues of cutting oils and compounds adhering to their surface. Such flashings, etc., tend to break away when impacted by the flowing plastic material, and will become embedded therein to produce an unsightly mark or excrescence on the surface of the part. Oil residues tend to burn off when in touch with the hot plastics material, giving rise to gas or fume pockets and resultant porosity voids in the wall of the moulding, which latter would be a source of structural weakness and some blemish.

Cylindrical Pin Inserts

Considering now the various forms of inserts used, and the methods commonly adopted for retaining or "keying" them into the wall of a moulding, etc., perhaps the simplest form will be that of a cylindrical pin, in steel or brass, having a portion of its length threaded to provide fastening facilities, after the fashion shown in Fig. 1. Whilst these diagrams are intended chiefly to illustrate anchoring methods and features, they will also serve to indicate several other unsatisfactory and also preferred design features worthy of attention.

Diagram A (Fig. 1) shows the relevant bossed-up wall section of a moulded article into which the end of a cylindrical pin insert has to be secured, embedded in such a manner that the insert will be resistant to radial and lateral movements relative to the moulding. The pin insert is the same diameter throughout its entire length. The left-hand end of the piece is provided with axial or "straight" knurling reproduced by ordinary machining.

The remaining portion of the pin is given a standard thread to receive a locking nut or other fastening device. This portion of the pin will project beyond the endface of the moulding, as shown. The threads are carried up to the commencing point of the knurled portion.

In practice, provision of such a "straight" type of knurl will prove unsatisfactory by reason of its inability to arrest lateral movement of the insert. It will, in fact, only give retention of the pin against rotary movement and the only force acting on the insert to prevent endwise movement will be the normal radial contraction arising from the shrinkage of the plastics material upon solidification.

For most industrial or utilitarian purposes this pressure would be grossly insufficient, and such an insert could be very easily disturbed axially, or even drawn out completely from the moulding wall, during normal use.

Another unsatisfactory point to be noted is that the knurled portion is allowed to project beyond the right-hand endface of the moulding for a small amount. This would lead to several difficulties. For instance, fins and flashings would be formed at that point due to fine slivers of plastics material flowing axially along the serrations past the endface of the wall.

Because the threaded part of the pin joins closely with the exposed knurled

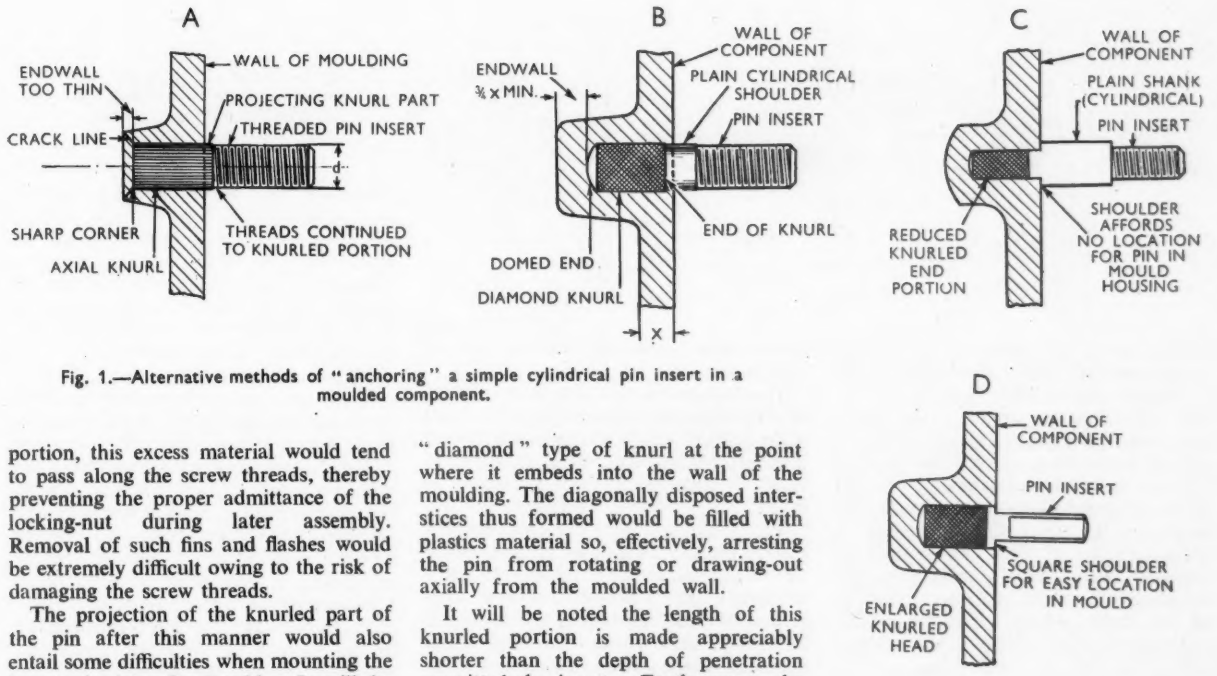


Fig. 1.—Alternative methods of "anchoring" a simple cylindrical pin insert in a moulded component.

portion, this excess material would tend to pass along the screw threads, thereby preventing the proper admittance of the locking-nut during later assembly. Removal of such fins and flashes would be extremely difficult owing to the risk of damaging the screw threads.

The projection of the knurled part of the pin after this manner would also entail some difficulties when mounting the insert pin into the mould. It will be extremely difficult to maintain the external diameter of such knurled portions exactly uniform pin for pin, and since this critical portion of the pin would have to be seated into a support hole in the mould cavity wall, diameter variations of the kind noted would cause trouble. Some pins would be too large for admittance, others might be undersize, resulting in an additional amount of clearance and the formation of increased flash.

Another undesirable feature to be observed in respect of this form of anchoring relates to the thickness of wall section immediately surrounding the embedded portion of the insert.

The extreme left-hand end-face of the pin is finished perfectly flat and with a sharp corner. This of itself would be sufficient to cause additional stressing of the wall, and when coupled with a very thin wall section as shown, cracking could easily ensue. As will be observed, the end-wall of plastics material at the extreme left is only about one-quarter the diameter of the insert pin, and where such conditions obtain, cracks would be liable to develop along the direction shown in heavy solid line in the diagram.

In this example the diameter of the boss at the left of the wall of the moulding is also too small, resulting in an insufficiency of material to withstand normal contraction pressures attendant upon the cooling and shrinkage of the moulding. Further cracking would tend to occur from this cause.

Diagram B (Fig. 1) shows a much superior form of anchoring such a cylindrical insert pin. With this example, the pin is provided with a cross or "diamond" type of knurl at the point where it embeds into the wall of the moulding. The diagonally disposed interstices thus formed would be filled with plastics material so, effectively, arresting the pin from rotating or drawing-out axially from the moulded wall.

It will be noted the length of this knurled portion is made appreciably shorter than the depth of penetration permitted the insert. Furthermore, the exposed threads on the right-hand end of the insert are not carried right up to the knurling, as with the previous example. Instead, a plain parallel portion is left, this being made a substantial length, i.e., from $\frac{3}{4}$ to 1 times the diameter of the pin. This plain portion extends into the wall of the moulding for a distance of about $\frac{1}{8}$ in., thus effectively sealing off the ends of the knurl and preventing material from flowing along the pin. This will preclude the formation of fins and flashes around the pin and complete safeguarding of the threads.

The head of the insert pin embedded within the wall material is also well domed, as illustrated, in order to minimize contraction strains and to lessen the risk of cracking the walls of the boss. This latter part of the moulding is made considerably larger so that the surrounding wall material will be not less than $\frac{3}{4}$ the thickness of the main wall X.

No troubles would be experienced in mounting such an insert pin into the supporting hole in the mould cavity prior to production, because the plain, cylindrical portion in the middle could be closely controlled in diameter and an accurate fit ensured in the supporting hole.

Diagram C (Fig. 1) shows another somewhat unsatisfactory type of pin-insert mounting and fixing, which is sometimes adopted when the pin has to be of the shouldered kind, as shown. In this example, the pin is threaded for a certain distance at one end and diamond knurled at the opposite end for the requisite length. The diameter of this knurled portion is considerably reduced in comparison with the size of the plain cylindrical middle portion.

A square shoulder is provided at the junction between this enlarged plain centre portion and the knurled stalk, which latter has to be embedded in the wall of the moulded article. All three portions of the pin are formed exactly concentric with each other, and the knurling is not carried fully up to the shoulder, as will be noted. The presence of this square shoulder in the form shown would, in practice, be a source of some difficulty, particularly when mounting and locating the pin in its mould block guide hole, to have the correct amount of projection into the critical cavity area.

Considerable care would be required when fulfilling this operation to ensure the square shoulder being accurately aligned with the side of the cavity wall, with which surface it would have to be in perfect alignment. This would be rendered difficult owing to the fact that the only portion of the pin interjecting into the cavity would be the small-diameter knurled stalk, and the square shoulder thereon could be utilized as the positive stop for positioning the pin.

The member would have to be determined in such setting by the overall length and the depth of the guide hole formed in the mould block. Any discrepancies occurring with such a critical setting as might easily arise due to variations in the overall length of the pin, relative to the depth of the guide hole, would incur one of two objections in the finished article.

(a) If the insert pin were to be short in

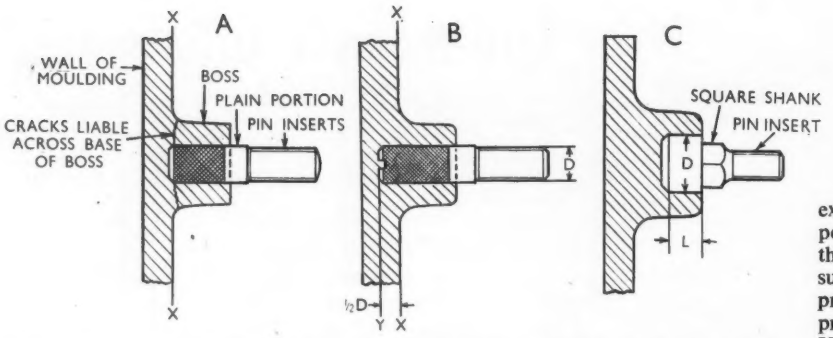


Fig. 2.—Three examples showing design points to be considered in connection with pin inserts.

length, the square shoulder would then be situated too deeply in its guide hole, resulting in that shoulder lying below the wall surface of the cavity. This condition would give rise to the formation of a thick collar flash around the base of the plain cylindrical portion, due to the plastics material filling up the space thus caused by the depressed shoulder face. Difficulties would then be entailed in removing such flash from the finished moulding, because of the intervention of the pin shank, which, of course, would preclude the presentation of an ordinary cutting tool, etc., to the flashing.

(b) If the pin were made in excess of the correct overall length the square shoulder would be caused to project into the cavity area a certain distance, and that portion would then be moulded into the wall of the component. This would mean that the length of the exposed portion of the pin would be too short, whilst that of the embedded portion would be too great. This latter might easily result in the endwall of the bossed portion being formed too thin, thus giving rise to a certain weakness in the finished moulding. Thus for the accurate and safe location of a shouldered insert pin of this kind, the overall dimension of the piece would have to be very closely controlled, necessitating a degree of precision which would certainly add to the cost of the insert.

Further, the use of a knurled stalk of such reduced diameter might, under certain circumstances, give only a weak form of retention. If the diameter of this portion were to be unduly small, the pin would be liable to deflect or bend easily when subjected to loading, etc. This drawback could to some extent be overcome by moulding a short portion of the large-diameter plain shank into the wall of the component.

A much more satisfactory type of fixing for a shouldered pin insert is shown at D (Fig. 1), where again retention is derived by means of a knurled stalk portion thereon as with previous examples. This portion of the pin, however, is made substantially larger in diameter than the threaded part which has to be exposed out of the moulding. A perfectly square shoulder is left between these portions as illustrated, this shoulder lying exactly contiguous with the external surface of the wall on the component.

The knurling is not extended fully up to this shoulder so as to leave a short, plain portion which will prevent plastics material from squeezing along the knurled serrations to form a flashing as noted with preceding examples.

To mount and locate a shoulder pin insert of this kind will be comparatively simple because its correct disposition into the cavity area, and the amount of projection therein afforded to the critical knurled portion, will be controlled by the shoulder itself, which part would be positively abutted against the side wall of the cavity. Thus the guide hole supporting the pin could be made considerably deeper than the length of threaded portion to be inserted therein.

The mounting of such a pin would be much simpler than with the example C, and could also be performed with closer accuracy regardless of minor variations of the overall length of the member. A more powerful retention would also be obtained because of the very much larger surface area on the embedded knurled portion, thus rendering this form of fixing admirable for those cases where heavy loading has to be imposed on the insert.

The three examples given at Fig. 2 illustrate several other important design points to be considered in connection with pin inserts.

Diagram A shows a very undesirable form. The retention of the pin is obtained by means of a short-length knurled portion as before, which has to be moulded into a small raised boss on the outside of the component wall. It will be seen that the length of insertion of this knurled part of the pin is almost equal to the length of the boss itself, thus bringing the end of the pin in line with the surface X—X of the component wall. This would involve some risk of cracking occurring radially across the root of the boss coincident with line X—X after the fashion shown. If the surrounding walls of the boss were to be kept very thin, the tendencies towards such crack formation would be greatly increased, especially if heavy loading and axial pulls were to be imposed on the exposed threaded end of the pin.

Diagram B (Fig. 2) shows how this danger may be easily overcome by extending the length of the knurled portion penetrating into the boss, so that the innermost endface of the pin will lie substantially to the left of line X. For preference the end of the pin should project beyond line X so that distance X to Y will be not less than half the diameter "D" of the pin.

Diagram C (Fig. 2) depicts yet another common weakness often encountered with pin-insert fixings. In this case the knurled end of the pin is of very much larger diameter than the exposed threaded stalk, but is of very short length, extending, in fact, little more than half way into the boss. This would mean in practice that the moulded-in pin would be easily misaligned, a condition liable to occur either during the actual moulding, because of the little guidance afforded the member, or later as a result of severe service use. For best results the length L of the knurled portion of such a pin insert should be made from 1½ to two times the diameter D of the member.

A further unsatisfactory feature is also associated with this design. This relates to the provision of a squared shank between the large knurled and smaller threaded stalk portions. The presence of such a square would present certain difficulties, since the mouth of the support hole in the mould cavity wall would have to be similarly shaped for admittance of the pin. Such a square formation in the hole would have to be very accurately machined so as to be concentric with the remaining cylindrical portion. Furthermore, a certain degree of variation in the concentricity of the same two portions would be unavoidable in respect of the pin insert, unless an expensive form of machining could be borne by the unit costs.

Wherever possible, square, hexagonal, or irregular shank projections of this kind should be avoided in preference to parallel cylindrical forms, which will be relatively easy and inexpensive to reproduce in the guide hole, and upon the insert member itself.

The two diagrams at Fig. 3 illustrate two useful alternative methods which may be adopted for retaining or "keying" a parallel insert pin.

With example A this "keying" provision is of extremely simple form, comprising merely two shallow flats formed diametrically opposite on the sides of the pin. No knurling of the portion to be embedded into the wall is required, the filling up of the two flat portions with plastics material being sufficient to arrest both radial and lateral

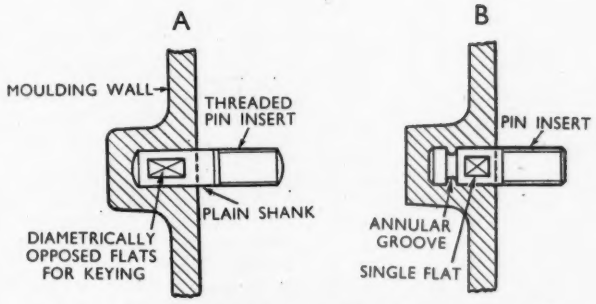


Fig. 3.—Two alternative methods for retaining or "keying" a parallel pin insert.

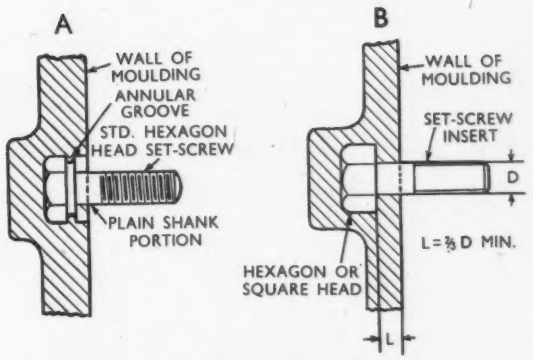


Fig. 4.—Two methods for obtaining maximum "keying" retention for a set-screw insert.

movement of the pin. The provision of a pair of flats after this manner will, of course, be rather more costly than simple diamond knurling, since the latter can be performed on the screw automatic lathe simultaneously with the threading and cutting off to length, whereas the two flats would have to be milled at a separate operation after turning.

With example B (Fig. 3) a single flat is employed at one side of the pin, this serving to restrain the member against rotation, whilst lateral movement will be constrained by means of a shallow annular groove of very narrow width, which is formed completely around the pin near the innermost end as shown.

Here again, no knurling of the embedded shank is required, since the annular groove when filled with plastics material will effectively prevent lateral movements of the pin, and the single flat will restrain its rotation. The depth of such annular groove may be from ⅛th to ¼th the diameter of the insert pin at that point, whilst the width of the groove may be made from one to two times the depth according to the magnitude of pulling load to be imposed on the exposed threaded end of the pin. For preference, the base of the groove should be slightly rounded after the fashion shown.

It will not be vitally important to have the annular groove formed concentric with the outside diameter of the pin, and the dimensions will not be subject to any close precision or have a high-quality surface finish. In fact, roughened surfaces will afford increased "keying" facilities by enabling the plastics material to obtain a closer grip of the metallic pin.

Both these forms of retention give effective results and will, of course, present no additional difficulties when mounting the pin into the guide hole in the mould cavity wall, other than the requirement that the overall length of the pin shall be maintained within reasonably close limits of variation.

Application of Standard Screws as Inserts

Very often the greatest facilities and economy may be derived by employing a standard headed screw as the insert in place of a specially formed stud of the kind previously considered. Fig. 4 shows two excellent ways in which such screws, either hexagon or square head-form, may be employed to obtain maximum "keying" retention.

Diagram A shows an ordinary hexagon head set-screw employed as the insert, having the head form embedded in the wall of the component. The hexagon shape will, of course, preclude all turning tendencies, but will afford little resistance to lateral pull on the screw during use. To overcome this weakness the head is provided with an annular groove as shown into which plastics material will flow and solidify.

The width of this annular groove will be the most important factor determining the degree of resistance to any endwise forces acting on the insert tending to draw it out of the moulded wall. Best results in this regard will be obtained by making the groove width about 1/3rd to 1/4 the height of screw head, whilst the depth may be carried slightly below the across/flats dimensions of the head. The base of the groove may usefully be rounded as illustrated.

Diagram B (Fig. 4) shows an alternative method which does not require any groove on the screw head. In this case, the head is moulded deeply into the wall in such a manner that the square shoulder immediately underneath the head is utilized to arrest endwise movement. With this form of "keying" the dimension L should be not less than 2/3rds the shank diameter D of the screw, so that a sufficiently thick retaining wall may be provided to resist pulling pressures.

With both these methods of fixing it will be noted that a certain length of plain portion must be left on the screw shank in order that the commencement of the threads shall be situated well away from the side of the moulding wall, to obviate accidental flashing along the threads. Both styles of fixing will also necessitate a larger bossing of the wall to ensure a sufficient thick and strong surrounding wall about the embedded head portion of the screw.

Standard screws may be obtained having suitable head forms, and which are not threaded close up to the head, so that such members may be used for insert purposes without any alteration.

Where a relatively small boss has to be employed in conjunction with such set-screw inserts, it will be advisable to remove the sharp corners occurring on the six flats so that cracking tendencies will be eliminated. Such rounding may be performed by a simple inexpensive machining operation.

Various forms of screw head may be employed in a similar fashion, thus square, knurled cylindrical cap heads, and ordinary cheese heads may be successfully applied often with little modification. Hollow screw heads are also extensively employed, especially where the exterior can be knurled, or grooved, to give additional "keying" against lateral pulls.

One advantage to be derived from use of headed set-screws of this kind is the simplicity obtained in mounting same within the guide hole formed in the mould cavity wall. The square step formed by the underside of the head can be abutted directly against the wall of the cavity to give exact radial location of the part, and close control over the amount of interjection of the head in the cavity area. This feature will often be one of the chief reasons leading to the choice of a screw insert rather than a plain cylindrical pin.

BRITISH MOULDED PLASTICS, LTD., tell us that prior to the recent General Election the company invited the candidates for the West Walthamstow Division to address employees during their lunch hour. Mr. and Mrs. C. R. Attlee came to the works on October 22; Mr. Edward Du Cann, the Conservative candidate, on October 23. As there was no Liberal candidate for this Division, Mr. George Thornton, Liberal candidate for East Walthamstow, came on October 19. All these gentlemen addressed the company's employees for about twenty minutes and answered questions, and were subsequently entertained to luncheon by the directors of the company.

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 2/- each.

B.P. 654,342. Appl. 16.11.48. Conv. (U.S.A.) 20.7.48. Acc. 13.6.51.
Moistureproof, heat-sealable sheet for wrapping material. To: British Cellophane, Ltd.

B.P. 654,351. Appl. 29.5.45. Acc. 13.6.51.
Synthetic resinous compositions. To: Cosmocord Plastics, Ltd.

For coating or printing thermoset materials, a saturated cyclic ketone of the cyclohexane series is condensed with phenol and an aldehyde in the presence of a basic catalyst and further intercondensed with a urea- or melamine-aldehyde mixture with an acid catalyst.

B.P. 654,391. Appl. 22.12.47. Acc. 13.6.51.
Preparation of new artificial resins capable of exchanging cations. E. F. Matthews, comm. from N.V. Centrale Suiker Maatschappij.

Cations are removed from solutions (for softening water) by passing the solution through a resin prepared from resorcinol with formaldehyde in the presence of glycerol.

B.P. 654,392. Appl. 24.12.47. Conv. (Czechoslovakia) 9.7.45. Acc. 13.6.51.
Mould for coating with rubber or other plastic material. J. Havlicek.

Plug and socket or similar contact connections are covered with plastic material by pressure injection moulding without the danger of tearing the conductors away from the contact members.

B.P. 654,445. Appl. 10.5.48. Acc. 20.6.51.
Plugs for plugging holes in materials for the reception of metal wood screws. C. E. W. Shemfeld.

The tubular wall plug is intended for electrical installations and is therefore made of insulating plastic material.

B.P. 654,455. Appl. 1.6.48. Acc. 20.6.51.
Moulding presses. W. Harrison, The General Electric Co., Ltd.

Hydraulic press with toggle arrangements for insulating or other mouldable materials.

B.P. 654,475. Appl. 23.3.48. Conv. (U.S.A.) 28.3.47. Acc. 20.6.51.
Coated sheet materials for use in the manufacture of heat-cured laminated articles. D. W. Elam. To: N. V. De Bataafsche Petroleum Maatschappij.

Sheets of bibulous or fibrous materials are treated with a mixture of an organic-acid ester of cellulose and a partial polymer of an organic polycarboxylic acid completely esterified with an unsaturated alcohol. The sheets are bonded by heat and pressure and may be used for fuel tanks, containers, stiffening materials, curtains, tents, umbrellas, table tops, flooring.

B.P. 654,477. Appl. 2.4.48. Conv. (U.S.A.) 30.4.47. Acc. 20.6.51.
Non-rubbery, free-flowing pulverulent vinyl chloride compositions and method of producing same. C. E. Parks, B. F. Goodrich Co.

B.P. 654,487. Appl. 28.5.48. Acc. 20.6.51.
Method of preparing cation exchange resins. A. Abbey, comm. from Dow Chemical Co.

A granular body of unwashed sulphonated phenol-formaldehyde resin is heated in a current of inert gas until it is free of water. The powdered product is adapted for use as an agent for softening water.

B.P. 654,550. Appl. 22.9.48. Acc. 20.6.51.
Making flattened thermoplastic tubing of predetermined desired characteristics. W. W. Triggs, comm. from Visking Corp.

A molten thermoplastic is continuously extruded in an upward direction, flattened while inflated by internal air pressure to the desired diameter when still in formative plastic state, and passed through a cooling ring.

B.P. 654, 561. Appl. 29.11.48. Conv. (U.S.A). 8.4.48. Acc. 20.6.51.
Esters of beta-hydroxy carboxylic acids and method of preparing same. W. L. Beears. To: B. F. Goodrich Co.

Useful as solvents and plasticizers for cellulose derivatives, vinyl resins, synthetic rubber.

B.P. 654,640. Appl. 11.2.47. Conv. (Switzerland) 18.2.46. Acc. 27.6.51.
Manufacture of artificial wood. To: Interwood A.G.

Wood shavings, splinters, straw are mechanically broken down but not reduced to fibres, then impregnated with a resin emulsion, preferably of phenol formaldehyde resin in the "A" stage of condensation. Suitable for building industry, furniture (instead of plywood).

B.P. 654,643. Appl. 1.10.45. Conv. (Germany) 11.12.42. Acc. 27.6.51.
Window frames. F. Fischl.

A metal core is protected by a coating of thermoplastic moulding composition with a base of polystyrene or cellulose acetate or products of superpolyamide condensation or of copolymerization.

B.P. 654,645. Appl. 11.4.47, 31.3.48. Acc. 27.6.51.
Manufacture of thermo-set plastic laminates, and products of such manufacture. D. Gonda. To: Holoplast, Ltd.

Two or more laminates are placed in a stack with separating layers sandwiched in between the laminates and, e.g., moulding elements in a press, these layers formed of moisture-proof cellophane or a metallic foil or of unplasticized polyvinyl chloride.

B.P. 654,646. Appl. 11.4.47. Acc. 27.6.51.
Thermo-setting plastic structural units and method of producing same. D. Gonda. To: Holoplast, Ltd.

A cellular panel is made of at least three thermo-setting plastic laminates with laterally spaced webs situated transversely between the sheets. The webs between the first and second sheets, between the second and third sheets and so on, are staggered, thus increasing sound and heat insulating properties.

B.P. 654,669. Appl. 6.10.47. Conv. (U.S.A.) 18.10.46. Acc. 27.6.51.
Adhesives for securing non-metallic friction material to the metallic backings of friction elements. F. J. Groten, R. J. Reid. To: Firestone Tyre and Rubber Co.

The bond between, e.g., a brake shoe and its friction facing consists of a butadiene-acrylonitrile elastomer (100 parts) and a phenol formaldehyde resin (75-500 parts).

B.P. 654,688. Appl. 12.3.48. Conv. (U.S.A.) 14.3.47. Acc. 27.6.51.
New resinous coating compositions and flexible sheets coated therewith. To. E. I. Du Pont de Nemours and Co.

The coating is composed of a copolymer of butadiene and acrylonitrile, a halogen—2—butadiene—1, 3 plastic copolymer, a halogenated ethylene polymer (chlorinated polyethylene). It is suitable for automobile tyres, hose, floor covering, many moulded articles.

B.P. 654,689. Appl. 12.3.48. Conv. (U.S.A.) 14.3.47. Acc. 27.6.51.
Modified polymerized haloprene compositions. To: E. I. Du Pont de Nemours and Co.

B.P. 654,698. Appl. 30.4.48. Acc. 27.6.51.
Moulding compositions. J. H. Williams, T. Ward. To: I.C.I., Ltd.

A novolac hexamethylene tetramine and an alkaline earth metal borate is admixed to phenol-aldehyde moulding compositions.

B.P. 654,730. Appl. 27.8.48. Conv. (Canada) 30.8.47. Acc. 27.6.51.
Compositions of polymeric 4-vinylcyclohexene dioxide. To: Canadian Industries, Ltd.

Polyvinyl acetal is dissolved in 4-vinylcyclohexene dioxide. The dioxide is polymerized in the presence of a catalyst.

B.P. 654,737. Appl. 20.9.48. Acc. 27.6.51.
Chemically resistant articles. F. K. Earp, A. E. Wiggs. To: Morgan Crucible Co., Ltd.

Tiles for linings of vats, pickling tanks, etc., are cast from a cashew nutshell resin polymer, a chemically resistant filler, an aldehyde or an aldehyde-yielding substance and an alkaline material to control the rate of setting.

B.P. 654,746. Appl. 25.10.48. Conv. (U.S.A.) 3.11.47. Acc. 27.6.51.
Concentration of aqueous formaldehyde solutions by distillation. To: British Celanese, Ltd.

B.P. 654,783. Appl. 17.8.48. Acc. 27.6.51.
Manufacture of continuous films or sheets of regenerated cellulose. C. A. J. Lindqvist, Svenska Rayon A.B.

Viscose solution is extruded from a pair of separate nozzles into coagulating liquid to form a film or sheet from each nozzle. The films or sheets are then contacted and fed together through a treating liquid, separated again and dried. Treating from one side only by penetrating liquid results in a uniform product.

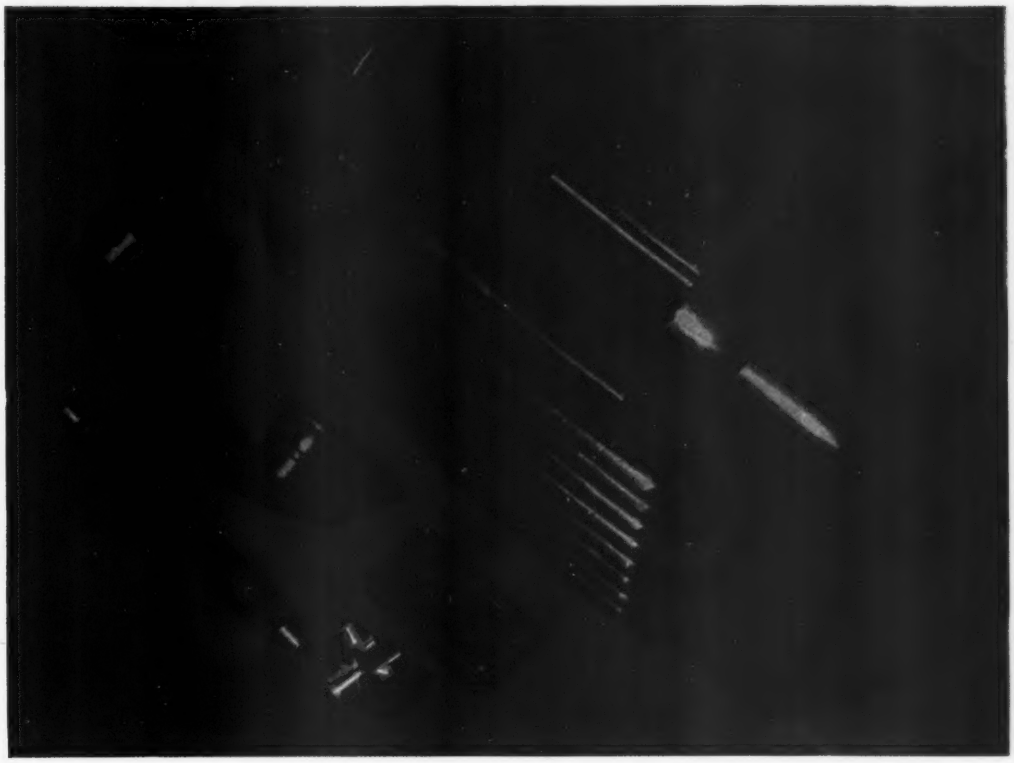
B.P. 654,784. Appl. 18.8.48. Conv. (U.S.A.) 25.8.47. Acc. 27.6.51.
Compositions comprising acrylonitrile homopolymers. To: American Viscose Corp.

Binary mixtures of nitromethane and α-hydroxy propionitrile provide a non-swelling solvent at room temperature. For tubings, sheets, rods, containers, etc.

B.P. 654,809. Appl. 24.11.48. Acc. 27.6.51.
Assembly of sheets of panelling. H. S. Newcomb. To: Bakelite, Ltd.

B.P. 654,855. Appl. 31.3.48. Conv. (U.S.A.) 2.5.47. Acc. 4.7.51.
Polyvinyl alcohol-diketene reaction products and process for producing same. G. D. Jones. To: General Aniline and Film Corp.

The new resins are intended for the formation of dyes in certain colour photography, but can also be cast and moulded as their physical properties are similar to those of polyvinyl acetate.



'MOULDRITE'

'Mouldrite' phenol-formaldehyde moulding powders are produced at I.C.I.'s modern factory at Wilton, where the latest developments in plant and processing techniques ensure a high-grade product that is uniform in quality, quick-curing and fully satisfies moulders' tight specifications.

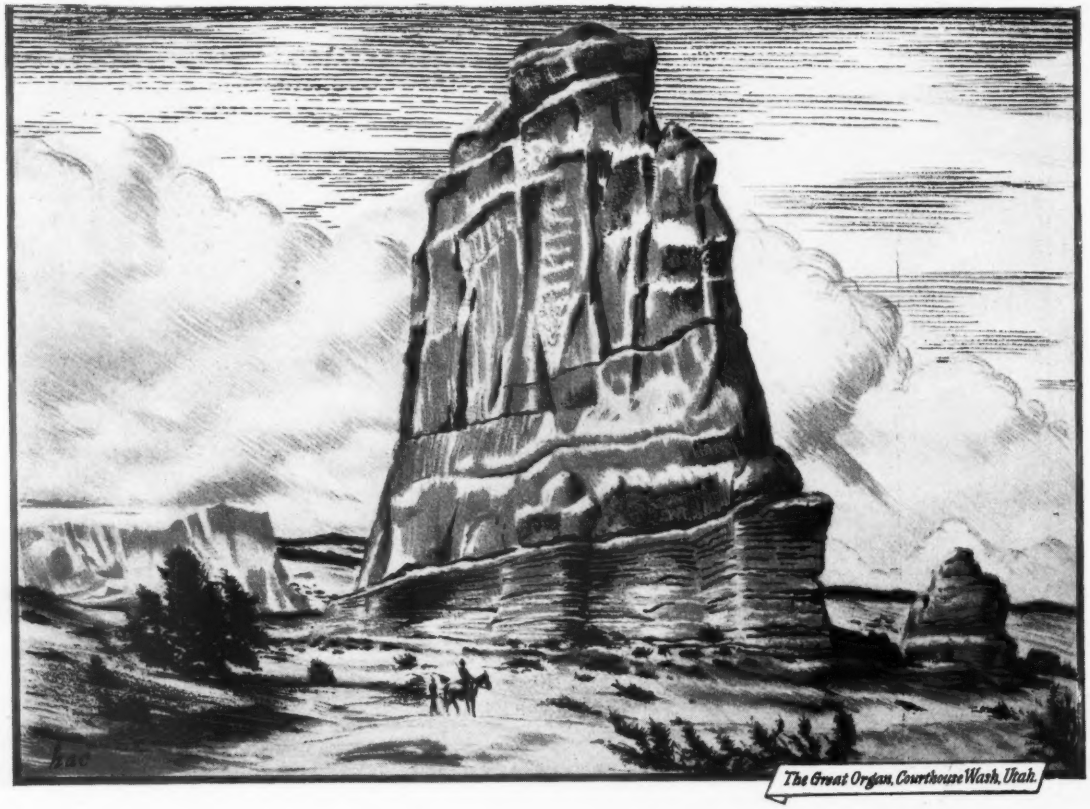
We are indebted to our customers for their co-operation in the production of this series of advertisements featuring end products made from I.C.I. Plastics.

'Mouldrite' is the registered trade mark of thermosetting moulding powders manufactured by Imperial Chemical Industries Limited.

IMPERIAL CHEMICAL INDUSTRIES LIMITED
LONDON, S.W.1

P.479

Arresting, Enduring...



The Great Organ, Courthouse Wash, Utah.

Matthey CADMIUM PIGMENTS

This striking rock formation has withstood the climatic changes of millions of years. In their own sphere, Matthey cadmium pigments are similarly outstanding for their qualities of endurance. Completely fast to light, they are particularly suitable for use in plastics, being chemically inert and unaffected by lubricants, solvents, plasticisers or by heat or moisture. Matthey cadmium pigments are free from any tendency to bleed, and because of their fine particle size are readily dispersed. They are available in colours ranging from yellow through orange to deep maroon.

One of the Specialised Products of

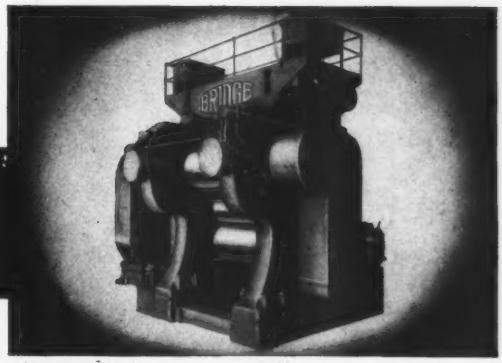
Johnson Matthey

Publication 1675 deals fully with the use of cadmium pigments in Polyvinyl Chloride, and we shall be glad to send you copies upon request. Please do not hesitate to write to us regarding any pigmentation problem you may encounter.

JOHNSON, MATTHEY & CO., LIMITED, HATTON GARDEN, LONDON, E.C.1

D189.

Precision Calender with three superimposed and one offset roller. Flood lubrication.



The Hallmark

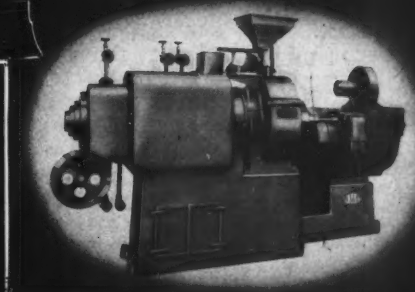
of DESIGN, SERVICE and PERFORMANCE *in* **RUBBER AND PLASTICS MACHINERY**

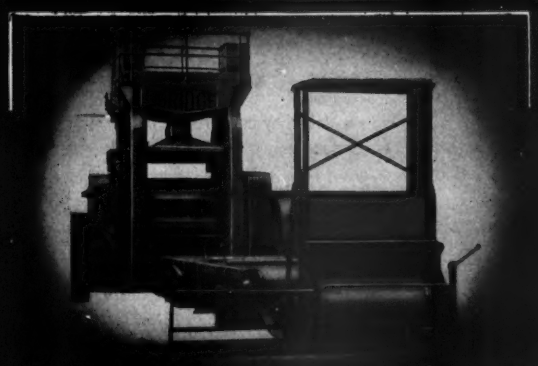
The Bridge — Banbury Patent Mixer. (1)

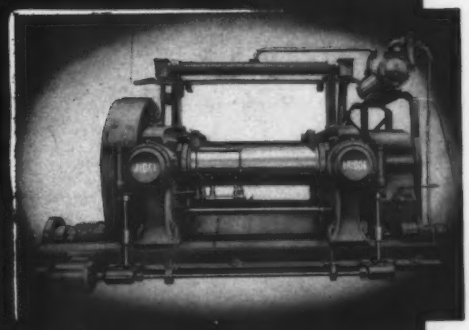
4½" Cold Feed Plastics Extruder. (3)

Precision Calender with four superimposed rollers. Flood lubrication. (2)

High temperature 22" x 60" Plastics Mill with flood lubrication. (4)

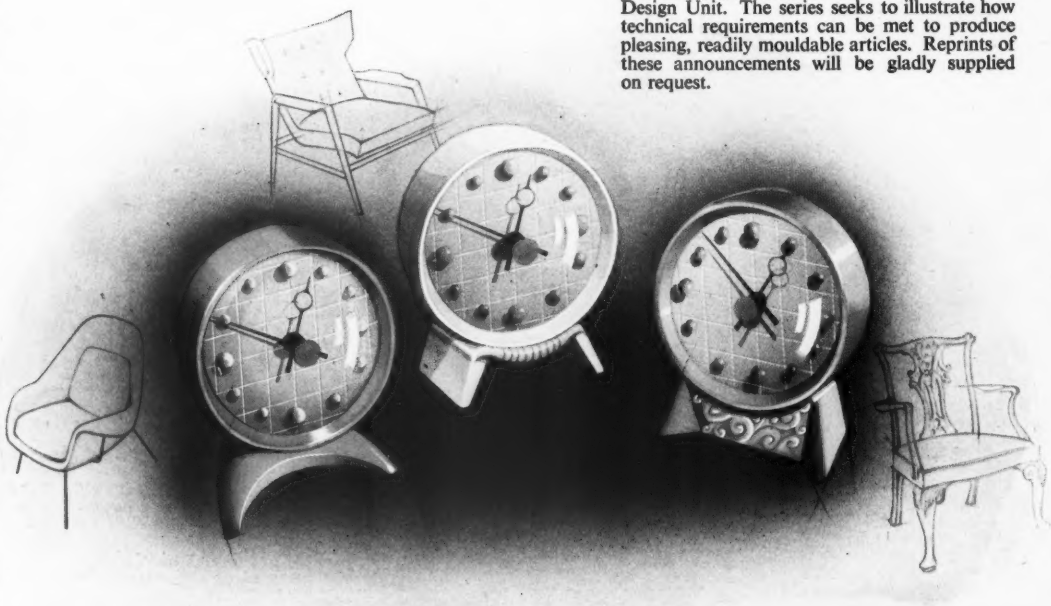






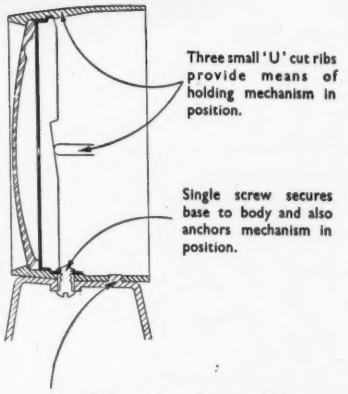
Designer's Diary No. 2

This is the second in a series of indicative designs for moulded plastics articles by the B.I.P. Product Design Unit. The series seeks to illustrate how technical requirements can be met to produce pleasing, readily mouldable articles. Reprints of these announcements will be gladly supplied on request.



The Product. A clock to fit its surroundings. Here is an attempt to provide a simple, readily mouldable clock housing with three separate stands, the characteristics of which suit the product to three representative furniture styles. Using a standard main housing with optional stands is far more economical than designing three separate clocks and just as satisfactory.

The Design. The clocks are conceived as two-piece mouldings for economy and interchangeability. All the bases are made by straightforward up-and-down moulding. The main housings require 3-plate stripper-type moulds to provide for undercuts which hold the mechanism in position. Housings are held to bases by a single screw which passes through into the metal structure to locate the mechanism. Bezels are made deep to protect the domed 'glass'.

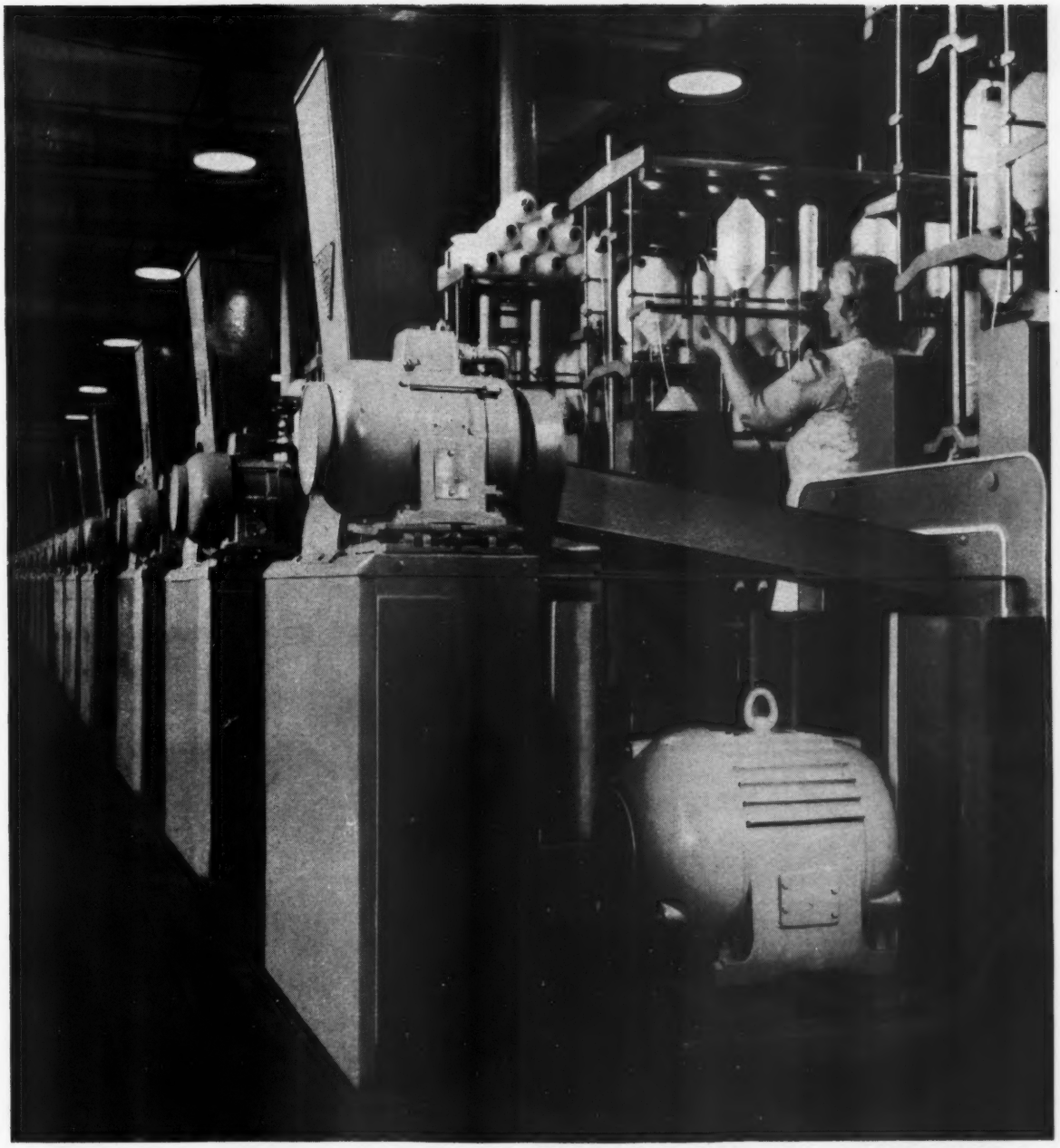

Three small 'U' cut ribs provide means of holding mechanism in position.
Single screw secures base to body and also anchors mechanism in position.
Dowel peg on base aligns mouldings.

The Material. Clock 'glasses' moulded from clear polystyrene or acrylic material, the bubbles being moulded in to give a 3-dimensional effect. Housings moulded from 'Beetle', chosen for its excellent colour possibilities. Vertical and horizontal lines produced by an overcheck material or by engraving on the clock face.

The B.I.P. Technical Advisory Service will assist moulders in problems which may arise regarding product design, mould design, materials and moulding techniques. This consultative service is freely offered, without obligation, and applies to moulding in thermoplastic as well as thermosetting materials.

BRITISH INDUSTRIAL PLASTICS LIMITED B·I·P GROUP **I ARGYLL ST., LONDON, W.I**

'BEETLE' is a trade mark registered in Great Britain and in most countries of the world



Individual electric drive at the Lily Mill, Shaw, Oldham—a part of the CYRIL LORD organisation

How to get the most out of your motive power

WITH ELECTRICITY you can take the power to the machine. Individual electric drive gives complete freedom for re-spacing of machinery to suit changing requirements and to give *maximum production capacity from a minimum power load.* Working conditions are improved by the absence of belts and shafting. Machines are driven at their optimum speeds and push buttons give complete control.

WHERE TO GET MORE INFORMATION

Your Electricity Board will be glad to help you to get the utmost value from the available power supply. They can advise you on ways to increase production by using Electricity to greater advantage — on methods which may save time and money, materials and coal, and help to reduce load shedding. Ask your Electricity Board for advice : it is at your disposal at any time.

Electricity for PRODUCTIVITY

Issued by the British Electrical Development Association

ANNOUNCEMENT

RUBBER IMPROVEMENT LTD. announce that the concentration at their Wellingborough factory has now been completed. Their new organization now represents one of the most modern and efficient productive units in the country.

Specialists in the supply of all types of P.V.C. sheeting film.

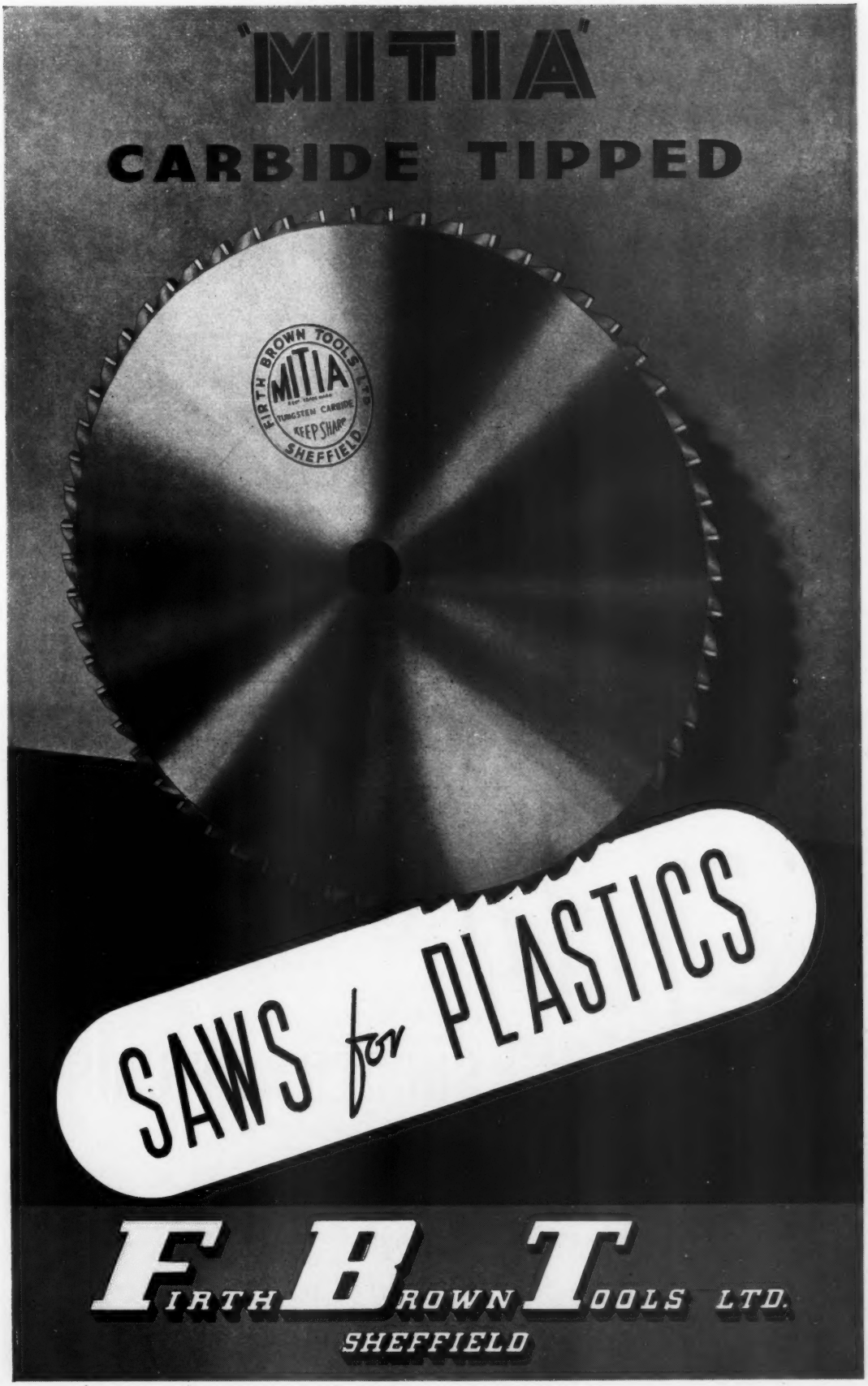
"RILENE"—Fine transparent and opaque frosted sheeting of superior quality in widths up to 54", and of special interest this sheeting is gauged from .0035/4 to .007/8. Full range of colours.
"RILON"—Embossed unsupported sheeting in 36" width, in thicknesses ranging from .016 to .022. Supplied in a selected variety of grains and colours.

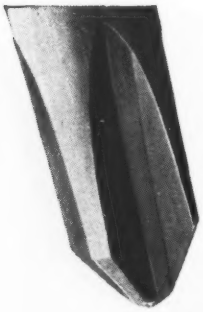
Fine embossed sheeting, opaque and metallic.
"RILSATIN"—The original satin sheen.
"RILCHECK"—The specially printed two colour check on our satin background (36" width only).
"RILWEAVE"—The formal basket design.
Available in 36", 48" and 54" widths, from .005 and .007/8.

Press polished sheeting in continuous lengths in any thickness.
Plastic conveyor belting and laminates of all kinds.
"DUREVER"—Plastic floor covering of superior quality, oil and acid resistant. In many original patterns, width 36".

MINISTRY and A.I.D. Approved.

All communications to Head Office :
LEONEX WORKS, HYTHE ROAD, LONDON, N.W.10.
Telephone : LADBROKE 2454.


"MITIA"
CARBIDE TIPPED
FIRTH BROWN TOOLS LTD
MITIA
TUNGSTEN CARBIDE
KEEP SHARP
SHEFFIELD
SAWS for PLASTICS
FIRTH BROWN TOOLS LTD.
SHEFFIELD



Available in a complete range of head styles

N-P-K

SELF-TAPPING SCREWS

WITH PHILLIPS RECESSED HEADS

THE PHILLIPS HEAD

The special driver mates perfectly with the recessed head and cannot slip. There is no risk of injury to the operator or damage to the article. This makes for faster, more efficient work with less strain on the user. Power driver bits as well as hand drivers are available for Phillips Heads.

THE N.P.K. THREAD

The hardened threads of Nettlefolds Parker-Kalon screws cut corresponding threads in drilled, formed or moulded holes. There is no need for tapping, tapping plates, inserts, clinch nuts or lock washers. N.P.K. screws simplify assembly methods and make stronger fastenings.

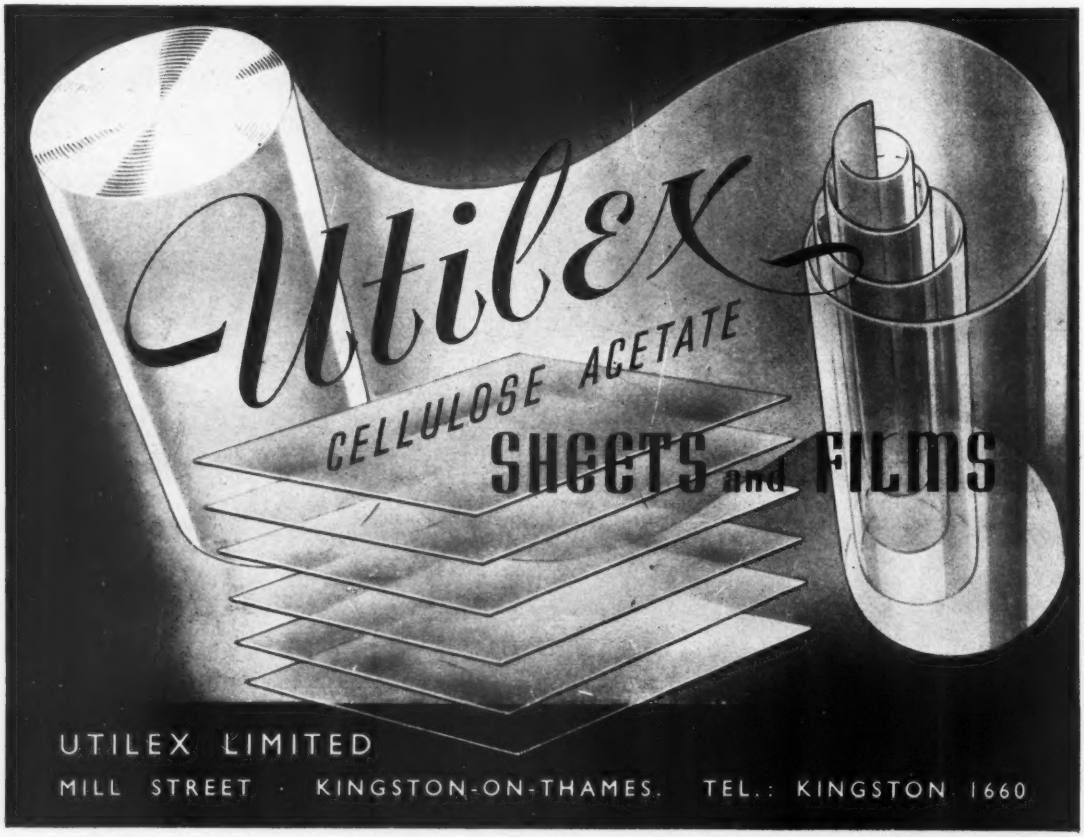
Full details on application from:

GKN

GUEST KEEN & NETTLEFOLDS (MIDLANDS) LIMITED

BOX 24, HEATH STREET, BIRMINGHAM, 18

S/P.NPK/2902



The Ferguson Tradition

The Virtue of Consistency

". . . eye of newt, and toe of frog,
Wool of Bat and tongue of dog . . ."

According to the Ferguson Archives, one of the Witches mentioned in "Macbeth" was a *very* distant Ancestress of ours, being the great-great-grandmother of Fergus O'Nestor. Although her personal character was as highly obnoxious as the hell-broth she prepared, she had one virtue—her meticulous care in selecting and blending the RIGHT materials for the cauldron, to ensure an *exact* result every time.

To-day, of course, Fergusons do not regard "*eye of newt and toe of frog*" as essential ingredients of "Nestorite" Moulding Powders, but they do adhere strictly to the tradition established by their Ancestress, that the right materials at the start will always produce consistent results.

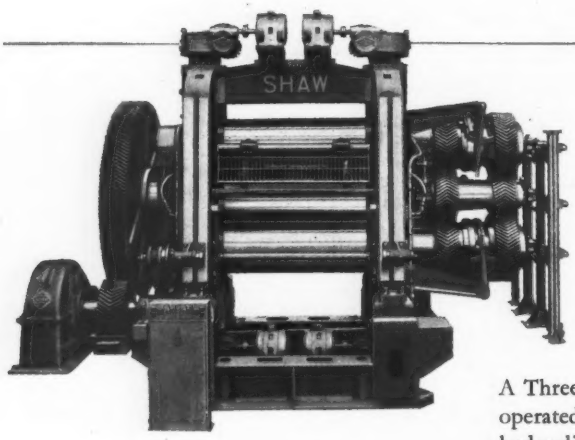
For this reason, the Ferguson Technical Organisation supervises every stage in the production of "Nestorite" Powders, thus enabling us to foretell the future in moulding characteristics somewhat more accurately than our Ancestress could . . . and our customers do appreciate this fact!

THE SERVICE IS RIGHT WITH NESTORITE

JAMES FERGUSON & SONS LTD.
LEA PARK WORKS, PRINCE GEORGE'S RD., MERTON ABBEY, LONDON S.W.19.
Telephone MITCHAM 2283 (5 LINES) *Telegrams* NESTORIUS SOUPHONE LONDON

A. S. HARRISON & CO. Pty. Ltd., 85, Clarence St., Sydney, Australia.
ANDRE BERJONNEAU, 134, Avenue de Villiers, Paris 17, France.
JOSE DELCLOS, Angel Baixeras, 39, Barcelona, (2), Spain.
EINAR HOLMARK 19, G1. Kongeyej, Copenhagen V, Denmark.

✻ KEEP IN STEP WITH THE TIMES



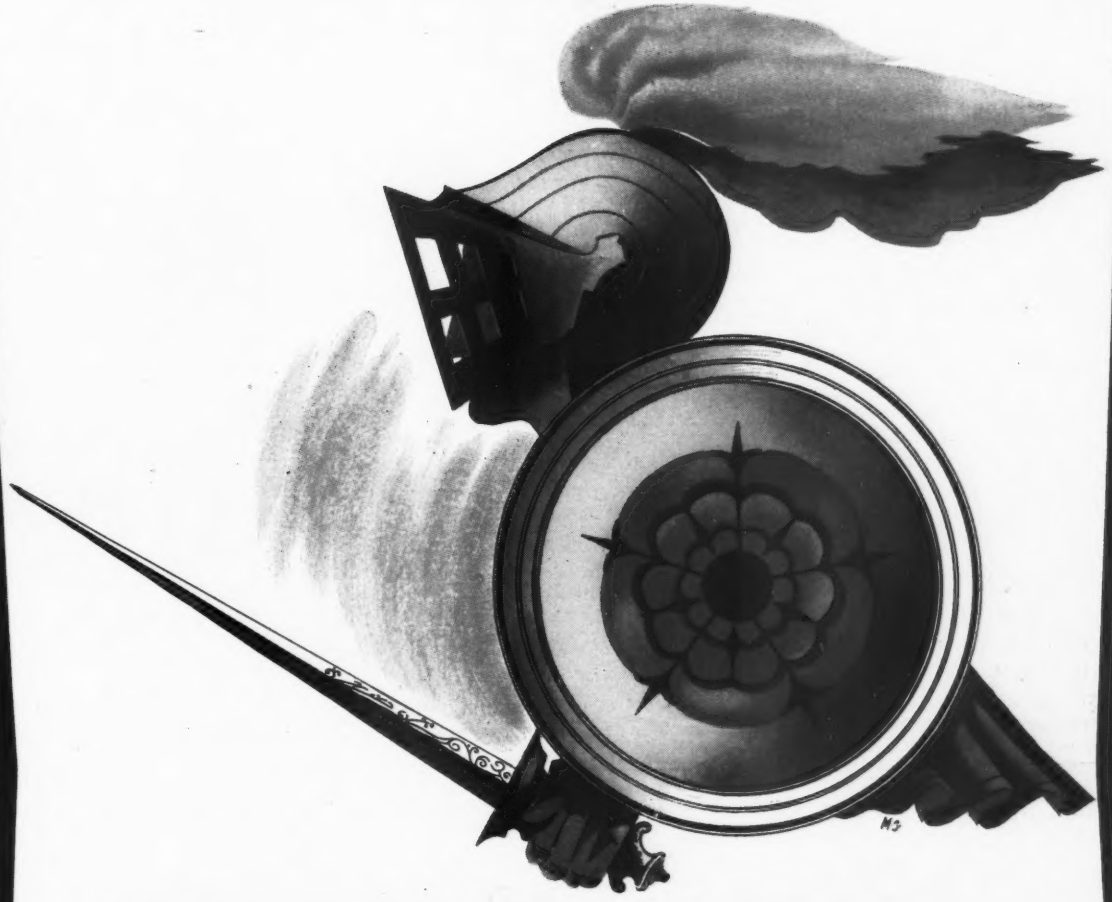
SHAW

In an industry as progressive as that of plastics manufacture, the engineer is constantly asked to accomplish the unknown, if not the "impossible." That is where SHAW experience of the whole field of plastics and rubber machinery comes in—with so many steps behind us, the next forward step comes readily to our enterprise.

A Three-roll Calender with four-motor individually power-operated roll adjusting gear, push button controlled, hydraulic jacks fitted to maintain constant pressure on top roll bearings and adjusting gear.
Flood lubrication to roll bearings for high temperature work and reduction of maintenance.

FRANCIS SHAW & COMPANY LIMITED · MANCHESTER 11 · ENGLAND

R.199



half your battle is fought!

The wheels within the wheels that turn together to produce world-famous "Tudor Rose" plastic products are now turning faster. R. C. MILLS of the Rosedale Group are making more Cellulose Acetate moulding powder and MANWOOD ENGINEERING now have an increased capacity for the production of tools and dies.

We are now able to offer selected Manufacturers, overseas, limited supplies of raw materials, tools and dies. All the experience of the Rosedale Group enables them to produce plastic products with the same high finish and consumer appeal that have established the fame of the Trade Mark "Tudor Rose" throughout the world.

This new service in no way affects the output of "Tudor Rose" toys and fancy goods, but we know that it will mark the beginning of a new era of greater co-operation in the plastics industry throughout the world. Half your battle is fought—our resources are at your disposal. Call on us now.

ROSEDALE ASSOCIATED MANUFACTURERS LTD.

CENTRAL HOUSE, 34/6, OXFORD STREET, LONDON, W.1. *Telephone : MUSeum 2694, 9772*

Cables : ROSEAM WESDO. Foreign : ROSEAM, LONDON.

FINNEY HYDRAULICS

FINNEY PRESSES LIMITED, announce the manufacture under license of the patented

GREER-MERCIER HYDRO-PNEUMATIC ACCUMULATOR

BRITISH PATENTS 527112, 572725, 595165 and 611934

ESSENTIAL FOR: Storing fluid pressure. Intensifying power in intermittent cycles. Absorbing shocks and fluid pressure. Dampening pulsations in hydraulic lines. Volume compensator and power conserver.

A VARIETY OF SIZES FOR A MULTITUDE OF USES. IDEAL FOR USE IN— Aircraft, Motor Vehicles, Hydraulic presses, Rock crushers, Ship's hatches and bulkheads, Oil drilling and Road building machinery, Boiler and Furnace Feed mechanisms.

Initial air or nitrogen charge in synthetic rubber bladder	020-2,000 p.s.i.
Oil or water Pressure from Hydraulic Service	0-5,000 p.s.i.

Our Engineering Department will assist in recommending suitable applications for hydro-pneumatic accumulators to meet your particular requirements.

NO HYDRAULIC MOVEMENT TOO SMALL OR TOO LIGHT TO BENEFIT.

Your enquiries will be welcomed for this or for special needs.

FINNEY PRESSES LIMITED,
BERKLEY STREET, BIRMINGHAM, 1
Telephone: MIDland 3795 (2 lines) **Cables: 'FYNHYD, BIRMINGHAM.**

HARRIS—*the Plastic Scrap People*

You are assured of fair prices, speedy collections and prompt payments if you offer your

"Perspex" Acrylic
Cellulose Acetate
Cellulose Nitrate
P.V.C. and all other
Thermoplastic Scraps

to

Alfred HARRIS & Co. (Richmond) Ltd.

MANOR PARK · RICHMOND · SURREY

Phone: 0028/9

NYMOL

Registered Trade Mark

PRECISION ENGINEERING COMPONENTS IN NYLON

★ We shall be happy to supply designers with data relevant to the special merits of Nylon as a new engineering material.

Plastic Engineers Limited

TREFOREST, GLAMORGAN

Telephones: Taffs Well 271–272

PE3

Pioneer Plastic House

NOTED FOR TECHNICAL ACCURACY AND DELIVERY. OVER 40 YEARS' EXPERIENCE. WE POSSESS A WELL EQUIPPED TOOL ROOM AND DEAL WITH REALLY DIFFICULT SUBJECTS.

Address enquiries to

MOULDING DEPARTMENT ← → **TURNING AND MACHINING DEPARTMENT**

W. H. TANT & CO. LTD.

DOLLMAN STREET, BIRMINGHAM, 7

Phone: ASTon Cross 3232

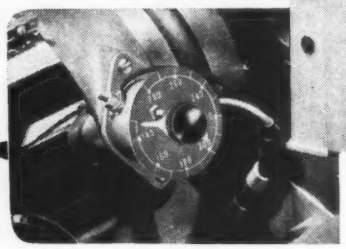
On this HUPFIELD machine

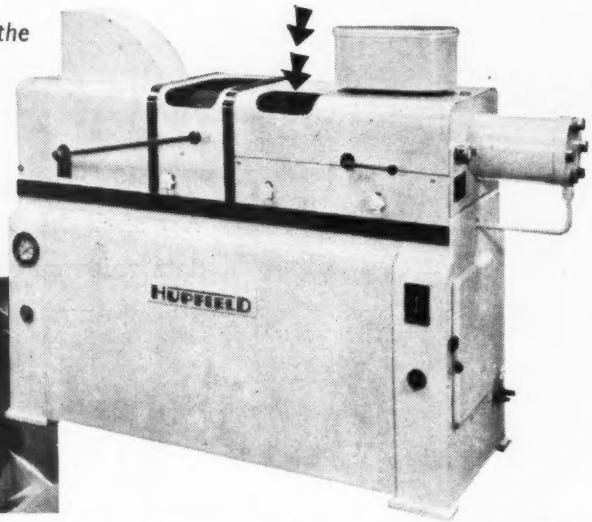
Temperature is automatically controlled within ± 0·5°C. by the

TEM-CON

ELECTRONIC SYSTEM

Fitted as standard on the well-known 1-oz. and 2-oz. Hupfield injection moulding machines, the TEM-CON sensitive element is shown in position on the heating cylinder.





Write for our suggestions.

P.A.M LTD.

MERROW, GUILDFORD, SURREY.

Telephone: GUILDFORD 2211

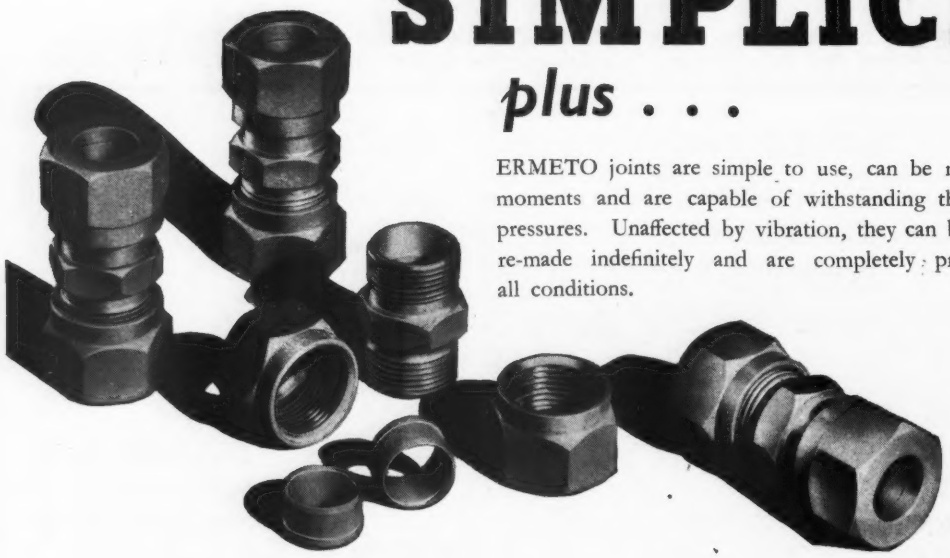
One of the group of companies associated with the Southern Areas Electric Corporation Ltd.

19550

SIMPLICITY

plus . . .

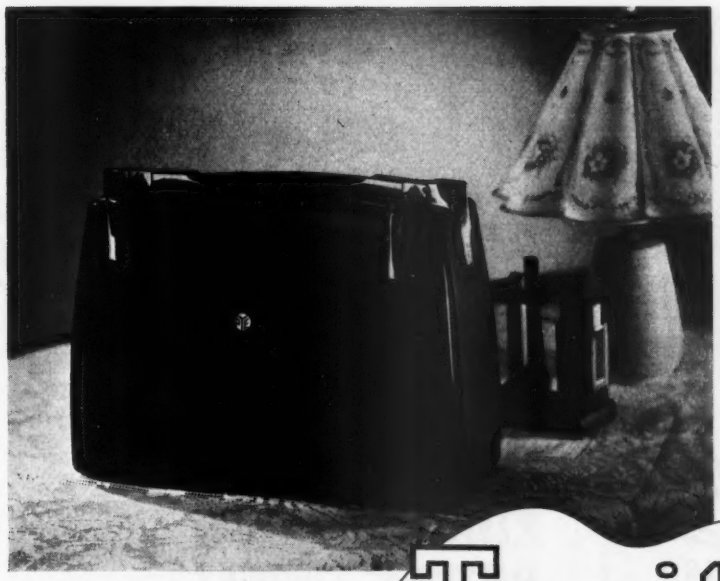
ERMETO joints are simple to use, can be made in a matter of moments and are capable of withstanding the highest industrial pressures. Unaffected by vibration, they can be made, broken and re-made indefinitely and are completely pressure tight under all conditions.



We are always pleased to forward copies of catalogue, price lists, etc., covering our standard ranges of pipe fittings and high-pressure valves.

ERMETO *SELF-SEAL COUPLINGS*

BRITISH ERMETO CORPORATION LTD., MAIDENHEAD, BERKS.



Radio case moulded for Pye Ltd. by B.X. Plastics Ltd. Halex Division.

'Tenite'
aids the designer

This attractive portable radio by Pye Limited appeals to the eye as well as the ear. The designer has achieved a striking effect by combining 'Tenite' in a lustrous black finish, with black 'crinkle' metal and chrome. He knew that the outstanding moulding properties of 'Tenite' were ample to allow the large front and back panels and hinged cover to be injection moulded. 'Tenite' also offered him toughness, great shock resistance and dimensional stability combined with lightness, high dielectric strength, and an almost unlimited range of colours and effects.

These qualities make 'Tenite' a first class manufacturing medium for a host of other jobs. Can they be of assistance to you?

Write for technical data, literature and moulding samples.

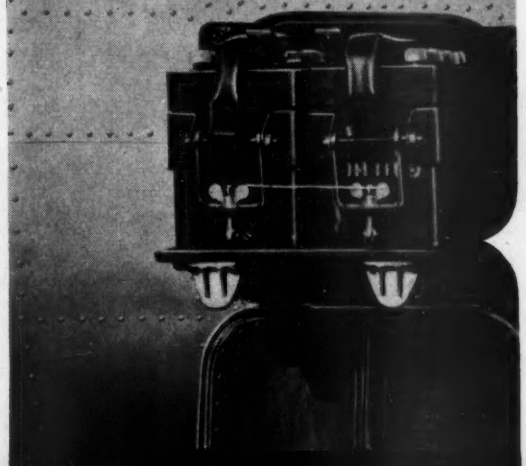
Tenite PLASTICS

T.E.C. Products Division

KODAK LIMITED WEALDSTONE, HARROW, MIDDLESEX. TEL: HARROW 4380 EXT. 26

'TENITE' is a registered trade-mark

DURESTOS
REGISTERED TRADE MARK



asbestos felt moulding material has *remarkable strength* combined with acid and flame resistance.

• The battery tray of the "DOVE" aircraft is made of "DURESTOS" Asbestos Felt Moulding Material.

Mouldings of "Durestos" Asbestos Felt Moulding Material have remarkable strength and dimensional stability linked with acid and flame resistance — that is why De Havilland use "Durestos" Asbestos Felt Moulding Material prominently in the D. H. "Dove" and other aircraft.
Considering its exceptional properties (particulars on request) "Durestos" Asbestos Felt Moulding Material is moderately priced compared with other laminates.

For further particulars write to:

TURNER BROTHERS ASBESTOS COMPANY LIMITED · ROCHDALE

A MEMBER OF THE TURNER AND NEWALL ORGANISATION

AF7a

Flextol
POWER-DRIVEN HAND TOOLS
Reg'd Trade Mark

N.G.F. 250 EQUIPMENT for the Toolroom

This equipment is ideal for making and maintaining jigs, dies, press tools, moulds, etc. It comprises a .45 h.p. Universal motor with built-in 2-speed gear, giving speeds of 10,700 and 1,500 r.p.m., flexible shaft and ball-bearing handpiece to take any of the 62 tools contained in the type T.C. 250 Tool Case. The standard equipment includes profile grinding wheels, rotary files, wire brushes, felt bobs, polishing mops, and arbors for each.

Illustrated folder on application.

THE FLEXTOL ENGINEERING CO., LTD.
THE GREEN, EALING, LONDON, W.5.
Phone: Ealing 6444/5/6/7. Grams: "Dominating," Ealux, London.

Midland Representative:
C. E. BLACKMORE, 9 Hillside Ave., Mapperley, Nottingham. *Phone : Arnold 68273*
Northern Representative:
J. H. BOGG, 10 Howard Road, Northenden, Manchester. *Phone: Wythenshaw 3061*
Western Representative:
T. SHEPPARD, 17 Stradbrook Avenue, Kingsway, Bristol, 5.

95-91

Send for LIST No. 250

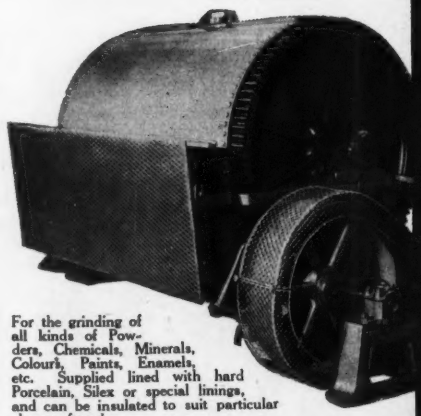
ETHER-WHEELCO ELECTRONIC CONTROLS

The Ether-Wheelco "Capacitrol" Electronically Operated Temperature Controller provides reliable and accurate control for Injection Moulding Machine nozzles and platens. The instrument operates instantly, and gives far closer temperature control than any other type of Controller on the market. The use of thousands of these instruments for this purpose has proved their accuracy and reliability all over the world.

ETHER LTD. TYBURN RD., ERDINGTON, BIRMINGHAM, 24
TELEPHONE: EAST 0276-7

Holdens

STEEL-SHAW PEBBLE MILLS



For the grinding of all kinds of Powders, Chemicals, Minerals, Colours, Paints, Enamels, etc. Supplied lined with hard Porcelain, Silex or special linings, and can be insulated to suit particular classes of work.

Send for our free illustrated literature

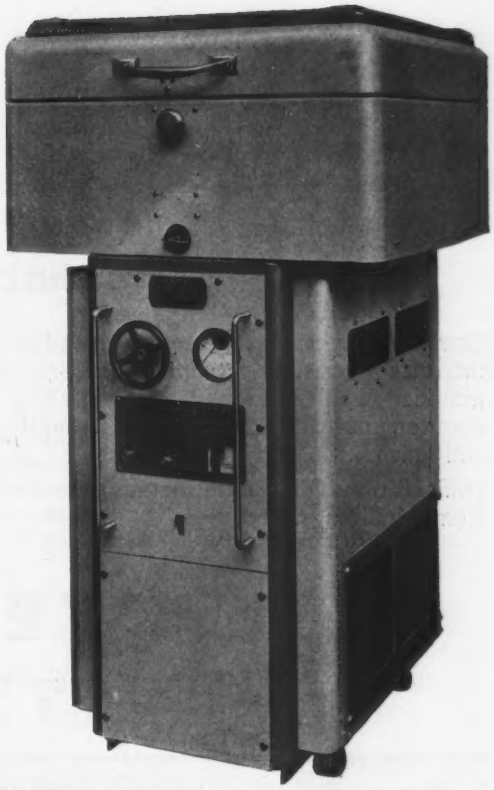
STEELE & COWLISHAW, LTD.,
Engineers (Dept. No. 27)
Head Office and Works:
COOPER STREET, HANLEY, STOKE-ON-TRENT
London Office: 329, High Holborn, W.C.
Telephone: Holborn 6023

Nearly ½ a Century's Experience in Grinding

ECONOMICAL PRE-HEATING

Redifon pioneered and still maintain their lead in the field of plastic pre-heating. Constant research and development are producing equipment of the most advanced standards of design, efficiency and reliability, combined with low running costs.

This 1.8 kW unit, Type RH.7B, will heat approximately 20 ozs. of G.P. moulding powder per minute at a cost of one twelfth of a penny per minute. Other units are available to meet most pre-heating requirements, ranging from 4 ozs. to 9 lbs. of powder per minute. We will gladly send full details of the Redifon range, or a technical representative to discuss your requirements. Please write, or call VANdyke 7281.



Redifon HEATING

INDUSTRIAL ELECTRONICS DIVISION

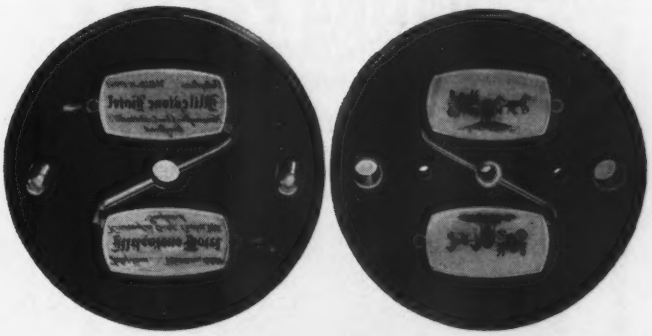
REDIFON LIMITED, BROOMHILL ROAD, WANDSWORTH, LONDON, S.W.18

Designers and Manufacturers of Industrial Electronic and Radio Communication Equipment

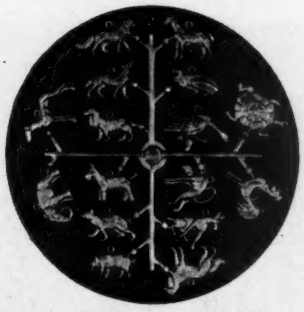
Prototypes to Production

PIGNON LIMITED

DIE SINKING, ENGRAVING
MOULD MAKING



By courtesy of INJECTION MOULDERS Ltd.



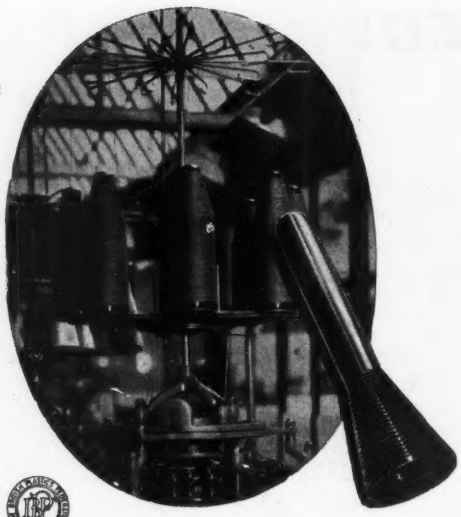
PIGNON PLASTICS LIMITED

COMPRESSION and INJECTION MOULDINGS

BRYANTWOOD WORKS, BRYANTWOOD ROAD, HOLLOWAY, LONDON, N.7.

Telephone: NORth 1326.

These bobbins are supplied to I. L. BERRIDGE & CO., LEICESTER for use on their knitting machines.



Mouldings that Matter

Our long experience in the design and production of intricate precision mouldings ensures that these moulded bobbins, for use on knitting machines, reach an unusually high degree of strength, uniformity and finish.

Difficult mouldings of this nature can safely be left to Kent Mouldings.

KENT MOULDINGS

PROPRIETORS: KOLSTER BRANDES LIMITED

FOOTSCRAY, SIDCUP, KENT

Telephone: Footscray 3333 Telegrams: Kolster, Phone, Sidcup

OUR NEW WASTE PAPER

BALING PRESS

has been designed to meet a demand of long standing for an inexpensive but well-constructed and strongly made Press, suitable for the average business.

It helps—

1. To keep your Premises clean and tidy.
2. To save Storage Space.
3. To increase the value of Waste.
4. To reduce the danger of Fire.
5. To prevent the contents of your Paper-baskets passing into unauthorised hands.

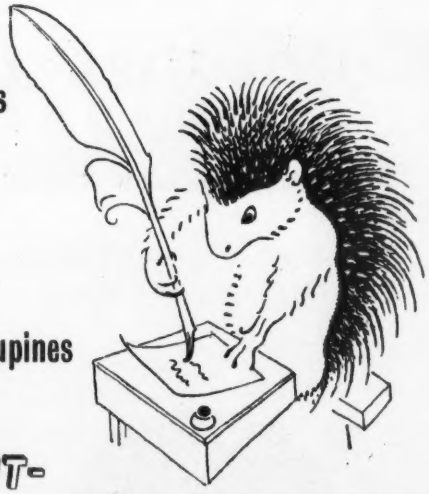
Full details from the manufacturers.

TYNE TRUCK & TROLLEY CO. LTD.

First Avenue, Team Valley Estate, GATESHEAD-ON-TYNE, 11

Telephone: Low Fell 77104 and 77105

Quills for Porcupines BUT-



TOOLCHROME for HARD CHROME DEPOSITS

Just as the Porcupine needs its quills to protect it from the hard knocks of life so plastic moulding tools must be hard-chromed to stand up to the seven-figure outputs *and*, at the same time, produce the high finish required. We specialise in hard-chroming of *all* jigs, moulds and tools—and in giving our customers prompt service.

TOOLCHROME LTD.

Annis Works, Annis Road, Hackney, London, E.9

Telephone: AMHerst 2735

— a T & N package can take it
BY LAND, SEA OR AIR

TRADE & MARK T&N

T & N Corrugated Fibreboard Cases and Corrugated Packaging are used extensively for export and home packaging of:—

FOOD AND CONFECTIONERY • WINES AND SPIRITS
ELECTRICAL GOODS • RADIO • MOTORING REQUISITES
CHINA, GLASS, HARDWARE • PAINT • PROPRIETARY
CHEMICAL PRODUCTS • LEATHER GOODS • BOOKS
FOOTWEAR • FRESH FRUIT AND CUT FLOWERS, ETC.

THOMPSON & NORRIS
Pioneers of Corrugated Packaging

THE THOMPSON & NORRIS MFG. CO. LTD.,
Great West Road, Brentford, Middlesex.
Telephone : EALing 4555

FACTORIES ALSO AT CORSTORPHINE, EDINBURGH · SHIRLEY, BIRMINGHAM · HISTON, CAMBS. · WARRENPOINT, CO. DOWN.

BALDWIN

'ATOMAT'

BETA-RAY THICKNESS GAUGE

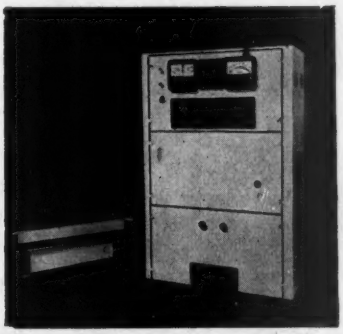
for continuous measurement in

PLASTICS PRODUCTION

The thickness and the deviation from a pre-set thickness are both indicated.

There is no contact with the material and no danger to operators.

Mains operated. Write for Leaflet P. 124



BALDWIN INSTRUMENT CO., LTD.
DARTFORD, KENT. Dartford 2989 & 2980

Your obvious choice for

EMBOSSING ROLLERS FOR P.V.C.

★ NYLON
★ SATIN, SILK
★ VELVET FINISHES
★ OR YOUR OWN MATERIAL
★ BY EMBOSSING ROLLERS IN ANY WIDTH OR DESIGN

Specify a Gilmar design

T·G·MARTIN & CO.
engravers of Embossing & Printing Rollers
OLD COLONY HOUSE · RIDGEFIELD · MANCHESTER 2
BLAckfriars 3022

Before you market—Mark it!

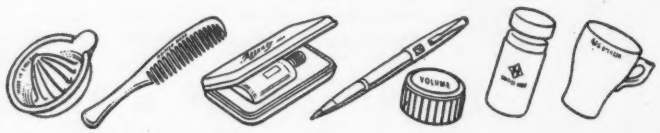
FUNDITOR

Sand-jet

MARKING MACHINES

The clear-cut mark is produced by means of a short blast of fine grit material through a rubber mask into which the trade-mark, numbers, letters, graduations or decorative designs have been cut. Marks Plastics, Ceramics, Hardened Steel, Stainless Steel, Carbide, Glass, etc. Also delicate thin-walled parts with ground or polished surfaces which cannot be impressed by other Marking Methods.

Send to-day for fully illustrated leaflet.



Funditor Ltd.

3 WOODBRIDGE STREET, LONDON, E.C.1 *Phone:* CLErkenwell 6155/7

Don't write off

ANY SCRAP

POLYETHYLENE

no matter how contaminated.

After reprocessing, we

guarantee insulating properties!

By a process unique in this country (and, to the best of our knowledge, in the world) we can undertake to reprocess your scrap polyethylene—no matter how contaminated—and to *guarantee its insulating properties.*

Polyethylene reprocessed by our methods can be *coloured to specification* **and can be reconstituted to your precise requirements in respect of plasticiser content, etc.**
We are able to offer limited quantities of reprocessed guaranteed material for sale and we are naturally interested in buying scrap in any condition at top prices.

In inviting your enquiries for our service—which we believe will reduce scrap loss and help to soften the effect of the shortage of materials—we wish to make it quite clear that we do not manufacture or supply prime polyethylene.

ALL ENQUIRIES TO:

POLYTHENE Limited

100 JERMYN STREET, S.W.1

Telephone: WHitehall 3978

VARIABLE SPEED DRIVES

FOR

Plastics Machinery

- CONTROL ADJUSTABLE WITH UNIT RUNNING OR STATIONARY.
- HAND, ELECTRIC REMOTE, OR AUTOMATIC CONTROLS.
- 27:1 SPEED RATIO ON FULL LOAD.
- MAY BE USED AS A CLUTCH TO PICK UP LOADS FROM ZERO SPEED.

CARTER GEARS LTD.

THORNBURY ROAD

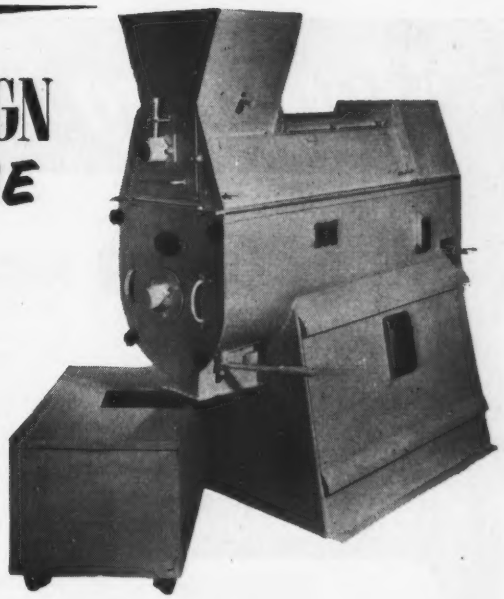
Phone: 64378/9 **BRADFORD** Grams: "Became"

PROGRESSIVE DESIGN

AHEAD OF ITS TIME

GARDNERS

of Gloucester



To retain their enviable reputation as pioneers in Powder Mixing and Sifting, the design of these machines are being constantly reviewed to provide maximum economy and efficiency. The Sifter/Mixer type "L" as illustrated embodies several improvements including :

- Totally enclosed stee construction to keep motor, drive and mixing chamber free from dirt and dust.
- Brush, Sieve and Agitator can be removed for easy cleaning without disturbing d ive.
- Outlet easily accessible. Self-contained rigid construction requires no re-alignment when installing.
- Latest type oil impregnated bronze bearings give easy running and complete support for long life under arduous conditions.

Machines for all Powder Processing can be supplied for all types of product, with special agitators or mixing chamber as required. Why not let us test a sample of your materials ?

WM. GARDNER & SONS (Glos.) LTD.
BRISTOL ROAD GLOUCESTER
Telephone : 21261 *Telegrams : "Gardner, Gloucester"*
LONDON **Albemarle House, Albemarle Street, W.1**
Telephone : GROsvenor 8206

Reliable supply of

MOULDING POWDERS

Cellulose Acetate
Phenol & Cresol Formaldehyde
and other
Thermoplastic & Thermosetting Powders

Industrial Plastics Ltd. offer manufacturers in Britain and abroad a continuous, prompt and reliable supply of many types of general and special purpose injection and compression moulding powders on most competitive terms. Technical consultative service is always available.

INDUSTRIAL PLASTICS
LIMITED

London and Export Office :
Piccadilly House, 16/17, Jermyn St., London, S.W.1
Telephone : GROsvenor 2848/9 *Cables :* IPLA, LONDON

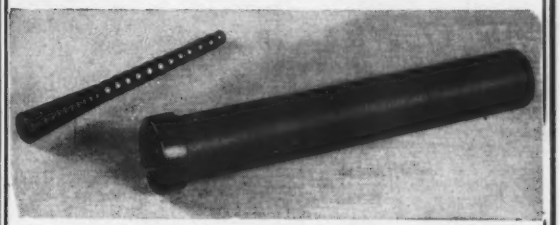
ALFA

FIRST IN PLASTICS

Our injection moulding capacity has been increased appreciably and we can now accept additional work for the trade.

Immediate Quotations on Receipt of your Drawings or Patterns

Early Delivery Full Technical Service



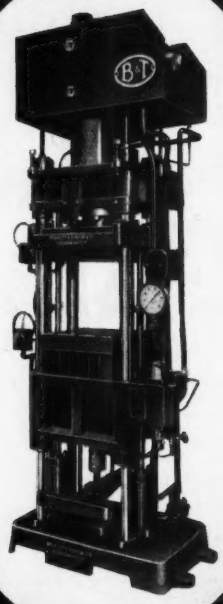
Supplying Industry all over the World

ALFA PLASTICS LIMITED
Members of the British Plastics Federation
20, The Highway, Stepney, London, E.1
Telephone : Royal 4011/4012

Moulding Equipment

HYDRAULIC PUMPS
HYDRAULIC ACCUMULATORS
PELLETING MACHINES
HYDRAULIC VALVES
AUTOMATIC MOULDING
CYCLE CONTROL UNITS

Press illustrated is No. 924, 75 ton self-contained semi-automatic, fitted with motor-driven pump unit and electrically heated platens. All movements of the press are controlled by a single lever control valve. These presses have a number of outstanding features and you are invited to send for full information.



B&T

Bradley & Turton Ltd

CALDWALL WORKS, KIDDERMINSTER

TELEGRAMS "WHEELS" KIDDERMINSTER • • • TELEPHONE 2217/8

Birmingham Office 114, HAMSTEAD ROAD, HANDSWORTH, BIRMINGHAM, 20. PHONE NOR 2519

THE LEADING MANUFACTURERS OF COMPRESSION MOULDING EQUIPMENT

50% SAVING
IN PRODUCTION TIME

Production can often be doubled with RADYNE Preheaters without extending your factory or installing more presses. ★The 500W RADYNE H5/A will fully plasticise up to 6 oz. of powder per minute. ★ Small presses can mould large parts. ★ Pin breakages eliminated. ★ No difficulty with very heavy mouldings. ★ Reduced electricity consumption per moulding. ★ Tool costs halved. ★ Better surface finish.

Send to-day for illustrated literature.

RADYNE

radio heaters ltd

WOKINGHAM · BERKS · ENGLAND

W. B. COLDWELL & SONS LTD.

DIESINKERS, MOULDS, JIGS.

89-91, ROCKINGHAM LANE,
SHEFFIELD, 1.
TELEPHONE: SHEFFIELD 24047.

DIPLOMA FOR DIE SINKING 1911

WE WANT TO BUY

Plastics Machinery of all types

Including:—**Presses of all types • Mixers • High Speed Pumping Equipment • Large Size Reciprocating Pumps • Large Accumulators • Rubber Mills • Calenders**

Please send full details to :—

GEORGE COHEN SONS & CO. LTD
WOOD LANE, LONDON, W.12 *'Phone: Shepherds Bush 2070 'Grams: Omniplant, Telex, London*
STANNINGLEY, NEAR LEEDS *'Phone: Pudsey 2241 'Grams: Coborn, Leeds*
And at Kingsbury (Nr. Tamworth) · Manchester · Glasgow Morriston, Swansea · Newcastle · Belfast · Sheffield · Southampton Bath · Dunfermline

THE 600 GROUP OF COMPANIES

P/516/HP13(WWB)

No Mould Costs if Stadium Ltd. have a mould ready to produce the articles you require.

No Waste of Time waiting many months for tools to be produced if the mould you need is amongst the many stock moulds of Stadium Ltd.

Profit from 20 successful years of moulding experience.

CONTACT

Stadium LIMITED

30-36, QUEENSWAY, PONDERS END, MIDDX. HOWard 2006

DECORATION of PLASTICS

Our new Universal Duplex Transfer can be used to decorate *ANY* plastic material. Rigid or Flexible, rough or smooth. Ideal for "Crinothene," embossed leather cloth, P.V.C., etc.

Let us send you samples and stock list.

P. L. AXON HARRISON, Jersey, C.I. (Eng.)

PRINTING ON PLASTICS?

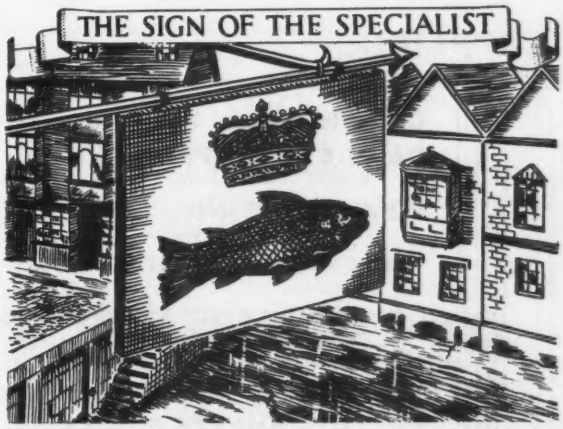
"SILKSCREEN"

An inexpensive and ideal process for single or multicolour printing on all flat PLASTIC materials.

BROCHURE and PRICE LIST on request

GAYLER & HALL LTD.
21/23 Regina Road, Southall
Middlesex Tel. SOU 3529

MANUFACTURERS OF EQUIPMENT & SUPPLIERS OF ALL MATERIALS FOR SILKSCREEN PRINTING



There are a few fishing tackle makers in London today (notably one in St. James's Street whose gilded sign is famous), and surviving records show that in the sixteenth and seventeenth centuries there must have been many.

London's river was busy then, but there were doubtless many quiet backwaters close to the busy City streets where an angler could find good sport.

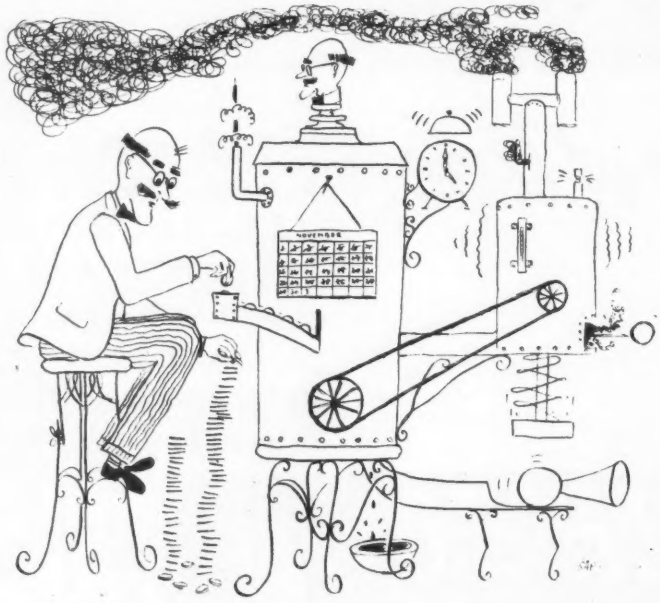
Today, he must go further afield to enjoy his favourite pastime, and as he goes, our familiar symbol may remind him — and you — that we are **specialists in small turned parts.**

WE STOCK UPWARDS OF 6,000 LINES OF SCREWS, NUTS AND SMALL ELECTRICAL PARTS

DAVIS & TIMMINS LTD

Head Office: BILLET ROAD, WALTHAMSTOW, LONDON, E.17
Telephone: Larkswood 2313 (6 Lines)
Stock Dept: BROOK ROAD, WOOD GREEN, LONDON, N.22
Telephone: Bowes Park 1136

You can save money every second every day ....



It's easy, at the stroke of every second you drop a penny into a monumental money-box made from annealed steel with a very high carbon content. After a while it becomes a habit and the tinkle of the falling lucre knocks the slow movement of that da, da, da thing by Beethoven into a cocked hat. It's rather tiring, though.

Economists in the Plastics Industry agree that this method of saving is only second to using reprocessed thermoplastics supplied by Dohm.

Forward then! Get in touch today.

DOHM LTD., 167, VICTORIA STREET, S.W.1

SUPPLIES FROM STOCK

CASEIN SHEETS RODS TUBES

CAST SYNTHETIC RESIN
SHEETS RODS TUBES PROFILE SHAPES

P.V.C. SHEETING
All thicknesses and widths

WARERITE PANELS
All colours

CELLULOSE ACETATE SHEETS
from 0.05" to 7 mm. thick. Opaque and Transparent. Flesh and T/shell Optical quality

I.C.I. "CRINOTHENE" in all shades

ACETATE SHEETS FOR LAMP-SHADES
All colours. Bexoid, May and Baker, Utilex, etc.

CELLULOID—all thicknesses

"PERSPEX" BRAND ACRYLIC RESIN SHEETS
from 1/24" to 1"—Clear and Coloured

EBONITE SHEETS RODS

MOULDING AND INJECTION POWDERS

GILBERT GALEA

MERCHANT IMPORTER-EXPORTER
Established 1918
Dominion House, Bartholomew Close, London, E.C.1
Phone: MONarch 3994 & 6770. Grams: Gilgalbert, Cent, London

J H C & S

MOULDS
OF
DISTINCTION

J. H. CARPENTER
AND SON, LONDON, LTD.
TOOL MAKERS
107a, YORK WAY, LONDON, N.7
Telephone: Gulliver 3917

PLASTIC
MOULDINGS
to your requirements
FREDERICK W. EVANS LTD.
PLASTIC WORKS · LONG ACRE · BIRMINGHAM 7
Tel.: EAST 1286 (2 lines)

PLASTICS MACHINERY

250-ton Upstroke Hyd. Press. Working space 2 ft. 6 ins. × 1 ft. 2 ins. Daylight 1 ft. 2½ ins. W.P. 1 ton.

120-ton Upstroke Hyd. Press by DAVID BRIDGE. Working space 2 ft. 6 ins. Daylight 1 ft. 4 ins. Head and table cored for steam heating. W.P. 1,500 lb.

100-ton Downstroke Hyd. Presses by BRADLEY & TURTON. Working space 1 ft. 9 ins. × 1 ft. 8 ins. Daylight 2 ft. 3 ins. W.P. 1 ton.

75-ton Downstroke Hyd. Presses by BRADLEY & TURTON. Working space 1 ft. 6 ins. × 1 ft. 5 ins. Daylight 1 ft. 8 ins. W.P. 1 ton.

70-ton Downstroke Hyd. Press by JOHN SHAW. Electric platens 1 ft. 4¾ ins. × 1 ft. 2 ins. Daylight 11 ins. W.P. 2,000 lb.

New 50-ton "COBORN" Downstroke Hyd. Presses. Electric platens 1 ft. 5 ins. × 1 ft. 4 ins. Daylight 9¾ ins. Vickers' pumping equipment.

Emmerson & Renwick Tabletting Machine for tablets 1 1/16 in. cube. Output 150/200 per min. 6 vert. punches and dies. Belt driven.

3 Duncan Stewart Tabletting Machines for tablets up to 2¼ ins. dia. Fitted with adjustable ejector gear to give variable filling depth up to 1⅜ ins. Motorized 400/3/50.

3 Bradley & Turton Tabletting Machines, model P.2., for tablets up to 1¾ ins. dia. × ½ in. thick. Output 35 per min. Pressure 30 tons. Belt driven.

Single Punch Pelletting Machine by WALKER. Max. size ½ in. × ½ in.

2 Worsamm Tabletting Machines, rotary type, for tablets 1¼ ins. sq. Output 50/60 per min. 15 sets punches and dies. Motorized.

Double Trough Mixer, 4 ft. 6 ins. × 3 ft. 11 ins. × 3 ft. 5 ins. deep. C.I. constr. with twin horiz. shaft fitted finger type agitators. Two bottom outlets 6 ins. × 5 ins. hand op. slide. Pulley drive.

Horiz. Mixer, single trough 4 ft. × 1 ft. 9 ins. × 2 ft. 4 ins. deep. 'Z' type agitator. Pulley drive. Arranged hand tilting.

2 Horiz. Trough Pug Mixers, 3 ft. 10 ins. × 2 ft. 6 ins. × 2 ft. 6 ins. deep. M.S. constr. Spiral scraper type agitator. 6 in. outlet, worm operated. Hinged steel cover. F. and L. pulley drive through spur gearing.

Horiz. Non-tilting Mixer, double trough 2 ft. 9 ins. × 3 ft. 2 ins. × 2 ft. 6 ins. deep. Heavy glanded agitator. F. & L. pulley drive. 1½ in. dia. outlet to each trough.

Double Trough Type Tilting Mixer. Trough 2 ft. 8 ins. sq. × 2 ft. deep. Fitted double 'Z' type agitators. Hand op. tilting. Motorized 440V. D.C.

GEORGE COHEN SONS & CO. LTD

WOOD LANE, LONDON, W.12 & **STANNINGLEY, NR. LEEDS**

Tel.: Shepherds Bush 2070 **Tel.: Pudsey 2241**

THE 600 GROUP OF COMPANIES

P/5110/HP22

M. CALDERON LTD.

SPECIALISTS IN
THE MANUFACTURE OF
HEATING ELEMENTS
FOR THE
PLASTICS MOULDING
INDUSTRY

ALL ENQUIRIES TO HEAD OFFICE:

227 UPPER STREET,
LONDON, N.1. **CAN. 4696.**

IF YOU REQUIRE

PRESSURE DIECASTINGS

IN

MAZAK ZINC BASE ALLOYS

CONSULT

THE BIRMINGHAM PRESSURE (E. Hartland) DIECASTING

75, NEW SUMMER ST., BIRMINGHAM, 19

TEL.: ASTON CROSS 2036

PLASTIC RAW
MATERIALS
of all kinds

by

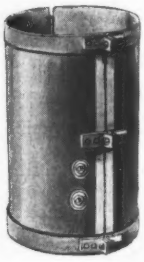
Chas. Page
& Co., Ltd.

for

HOME AND
EXPORT MARKETS

52, GROSVENOR GARDENS,
VICTORIA, LONDON, S.W.1

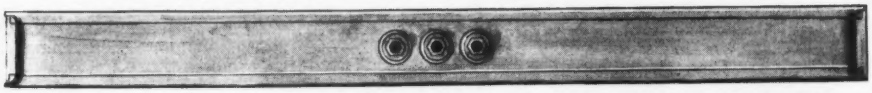
Telephone: SLOane 8151 (10 lines) Telegrams: Paganini-Sowest, London



ELMATIC Heating Elements

FOR THE PLASTIC INDUSTRY

BAND HEATERS · STRIP HEATERS IN MICA OR CERAMIC
CARTRIDGE HEATERS · TUBULAR ELEMENTS FOR METAL
AND AIR HEATING · SPECIAL UNITS AND RESISTANCES



PERKINS & SEWARD LIMITED

HEAD OFFICE: 56, ST. MARY STREET, CARDIFF. TEL.: 45623

REQUIRED

IN A DISTRICT NORTH & NORTH-WEST (LONDON TO COVENTRY)

MODERN FACTORY

MUST HAVE EXTENSIVE CLEAR FLOOR SPACE AND SUITABLE FOR A WELL-KNOWN

LIGHT ELECTRICAL MANUFACTURER

Full particulars, in confidence, are requested by

CHAMBERLAIN & WILLOWS
23 MOORGATE, E.C.2 CITY 6013

MICHAEL S. STEVENS

PLASTIC SCRAP

Buyers at Your Works of
Injection Scrap, Scrap Cuttings

Now at
KESWICK WORKS, KESWICK ROAD, PUTNEY, S.W.15
VANdyke 3345

PLASTICS AND BUILDING

By E. F. Mactaggart, B.Sc., A.R.C.S., M.I.Chem.E., and H. H. Chambers, Ph.D., A.R.C.S., D.I.C., A.R.I.C. This is an up-to-date and highly informative book, dealing fully with the composition and manufacture of plastics materials, and to a lesser extent with their applications in building and decoration, domestic and office furniture, and in electrical and other types of equipment. Coloured Isotype charts are used to illustrate molecular structures and certain technical points, and there are 16 full-page colour plates. 60/- net.

PITMAN,

Parker Street, Kingsway, London, W.C.2.

PIONEERS

IN

MOULDS

for MODERN PLASTICS

also

PRESS TOOLS, JIGS & GAUGES

BARBER & DUFFY LTD.
214/222 CARDIGAN ROAD · LEEDS
Phone: Leeds 52033

BYSON

FOR

BAKELITE

Acetate and other Synthetic Mouldings. Modern Plant and Facilities

APPLIANCE CO. LTD.,
WOOLFOLD, BURY, LANCS.
Telephone: Bury 1560-1. Telegrams: "Bysonite, Bury."

J. F. KENURE, LTD.

Injection Moulders to the Trade

Mouldings in all thermoplastic materials up to 10 oz., including flexible mouldings by the patented KENUTUF (P.V.C.) PROCESS.

Our facilities include:

Tool design and precision mould making.

Fully equipped modern tool room.

Capacity and facilities for fabrication, manipulation and assembly of plastic and metal components.

Consult us in your problems • Let our technicians help you

J. F. KENURE, LTD., FELTHAM, MIDDLESEX

Telephone: Feltham 2604-5-6

TUFFLEX

EXTRUSIONS
are our business . . .
Not just a department

AS the leading specialists in this field our technical staff welcome enquiries for all types of extruded plastics. We can promise you also keen personal service and a completely satisfactory product.

C&C MARSHALL LTD

PLASTRIP HOUSE, OAKLEIGH ROAD NORTH, LONDON, N.20

Telephone: Hillside 5041 (3 lines). Telegrams: Tufflex, Norfinch, London
Cables: Tufflex, London

LONDON & SCANDINAVIAN METALLURGICAL CO LIMITED

Injection moulds for small and intricate articles

Sole manufacturers of hard nickel electroformed cavities

DIES FOR REFLECTORS

CHELTON WORKS, GONSALVA ROAD, LONDON, S.W.8. MACaulay 5575

Plastic Scrap Wanted

Especially
P.V.C.
Scrap Offcuts

Large quantities of Transparents, Opaques, Prints, Metallics.
Spot Cash

Enquiries to:

DAVIS BROS.
(Metal & Plastics) Ltd.
20 All Saints' Road, LONDON, W.11
Park 5639

Classified Advertisements

The rate for paragraph announcements is 4d. per word, minimum 4s. —— Semi-Displayed Space 50/- per inch.
Series discounts: 5% for 6 and 10% for 12 consecutive insertions. Terms: Cash with order. Box number fee: 1/-

The proprietors retain the right to refuse or withdraw advertisements at their discretion and are not responsible for clerical or printer's errors although every care is taken to avoid mistakes.

AGENCIES

DUTCH AGENTS WITH SPECIALIZED TRAVELLERS covering whole Netherlands desire represent manufacturers of articles for electrical appliances, household goods and drugstore and hairdressers' equipment. Handelsonderneming L. Richoux, 192 Churchill Laan, Amsterdam, Z. 172-x4444

ADVERTISERS would like to hear from agents to sell, on commission basis, thermoplastic mouldings and assemblies. Facilities include mould design, mouldmaking, moulding, processing and assembly. Replies in confidence to Box P723, care of "Plastics." 172-42

BOOKS AND PUBLICATIONS—WANTED

WORTH-WHILE OFFER made for the following back numbers Plastics Institute Transactions:—January 1933, January 1934, January 1935. Would some kind person please contact Box P721, care of "Plastics." 172-43

URGENTLY REQUIRED to purchase, August and September issues (1944) of "Plastics" (Volume 8, Nos. 87 and 88). Also "British Plastics," January 1944 (Volume 16, No. 176). Minneapolis Honeywell Regulator Company, Minneapolis, 8, Minnesota, U.S.A. 172-13

BUSINESSES, PREMISES, OFFICES, ETC.

MODERN FREEHOLD SINGLE-STOREY FACTORY in Kent near Arterial Road and only 15 miles from London. Excellent light, 15-ft. headroom. Area 27,000 sq. ft. Freehold £65,000. Vacant possession. Further details—Chamberlain and Willows, 23 Moorgate, E.C.2. (City 6013.) 172-45

FOR PARTICULARS OF
FACTORY PREMISES
FOR SALE AND TO BE LET,
Areas from 5,000 to 100,000 sq. ft. in all parts of London and Home Counties.
APPLY TO
CHAMBERLAIN AND WILLOWS,
Industrial Property Specialists,
23 MOORGATE, E.C.2.
(City 6013.) 172-44

PLASTIC MOULDING FACTORY for sale as going concern, Midlands District. Established 20 years. Modern equipment. Box P7213, care of "Plastics." 172-33

FINANCIAL AND PARTNERSHIP

MANUFACTURER with long-term trade moulding contracts desires to contact working partner fully experienced injection and compression moulding, investment desirable but not essential. Box P717, care of "Plastics." 172-2641

MACHINERY, TOOLS AND PLANT

ALTERNATORS. Diesel sets, electric motors, switch gear, transmission equipment, fluorescent lighting and industrial fittings, ex-stock. Keen prices. Contact G. L. Murphy, Ltd., Menston, near Leeds. zzz-210

PLASTIC PLANT SPECIALISTS.
MODERN MOULDING PRESSES.
MIXING MILLS.
EXTRUDERS.
HYDRAULIC PLANT
Always in stock. Send us your inquiries.
Whatever your NEED ask
REED BROTHERS (ENGINEERING), LTD.,
REPLANT WORKS,
CUBA STREET,
MILLWALL, LONDON, E.14.
zzz-269

JACKETED PANS. Eight copper melting pans, 18 ins. diameter by 12 ins. deep with covers, mounted in steel frames with valves, steam traps, etc., as new, £25 each. Thompson and Son (Millwall), Ltd., Cuba Street, London, E.14. zzz-311

STOP THAT VIBRATION with "Muffelite" equipment. No problem too difficult, low-speed machinery or power hammers. No machine too small, none too large. Protects precision testing-plant; insulates buildings against all vibration, from generators to printing presses. Write for list 103. Cementation (Muffelite), Ltd., 39 Victoria Street, London, S.W.1. Abbey 5726. 172-2616

"IMPETUS" MACHINERY, ex-stock, belt grinders or sanders, 4-in. band, £7; motorized, £15 10s.; also 6-in. model, 13-speed motorized ½-in. drilling machines, £19; exhaust fans, air compressors, paint spray plants, etc.; catalogue from manufacturers. John P. Steel, Dept. 8, Bingley, Yorks. zzz-0267

B.C.S.
DIESEL GENERATOR SET
1,200 kW complete Diesel generating plant, comprised of two 1,250 b.h.p vertical 6-cylinder, solid-injection, two-cycle, single-acting super scavenge Diesel engines by Sulzer; 375 r.p.m. each, direct coupled to 600 kW Met-Vick. 220v. D.C. 3-wire compound-wound generator. Complete with switchgear; air starting equipment; exhaust systems; water-cooling tower and softening plant, fuel-storage tanks instruments, valves, gauges, piping, tools and spares.
Installed by Sulzer Bros. in 1948.
B.C.S. (ENGINEERS AND CONTRACTORS), LTD.,
CASTLE STREET,
CARDIFF.
Phone, Cardiff 8512-3-4. 172-2614

VIBRATORS and vibrating tables for hoppers, packaging, etc. Kolt Engineering, 70 Victoria Street, London, S.W.1. 173-02547

UNUSED 12-GALLON BEKEN DUPLEX MIXER, mild steel, glanded with vacuum cover and condenser, £475. Box P7117, care of "Plastics." 173-2644

Machinery, Tools and Plant (contd.)

8 OZ. P.E.C.O. INJECTION MOULDING MACHINE, self-contained unit with automatic cycle, hydraulically operated, little used, condition as new, maintained by manufacturers. Can be released November onwards. Seen any time by appointment. Godfrey Holmes (Plastics), Ltd., Wragby, Lincoln. Phone 304-5-6. 174-2683

INCORPORATORS.
Three Incorporators with steam jacketed stainless steel pans, 1 ft. 6 ins. by 11 ins. deep, with mixing paddles fitted for belt drive.
B.C.S. (ENGINEERS AND CONTRACTORS), LTD.,
3 CASTLE STREET,
CARDIFF.
Phone, Cardiff 8512-3-4. 174-2678

4 OZ. P.E.C.O. INJECTION MOULDING MACHINE, self-contained unit with automatic cycle, hydraulically operated, little used, condition as new, maintained by manufacturers. Seen any time by appointment. Box P7224, care of "Plastics." 174-2682

FIELDING AND PLATT HYDRAULIC PUMP, 65 g.p.m., at 1,500 lb., also accumulator, 12-ft. 8-in. diameter by 10-ft. 9-in., for sale at low figure. Box P727, care of "Plastics." 172-38

B.C.S.
VERTICAL BOILERS.
(1) 1,760/1,320 lb. per hour No. 9 size Cochran vertical multitubular boiler; new 1930; 100 lb. working pressure. Complete with fittings and mounting; prior automatic stoker, etc.
(2) 800 lb. per hour vertical cross tube boiler, new 1935, 3 ft. 6 ins. dia. mountings; Royles feed regulator; Weir feed pump; chimney, etc.
B.C.S. (ENGINEERS AND CONTRACTORS), LTD.,
3 CASTLE STREET,
CARDIFF.
Phone, Cardiff 8512-3-4. 172-02615

INJECTION MOULDING MACHINES FOR SALE. 1. N.V. 10 hand-operated 10 grammes. 2. N.V. 30 air-operated 30 grammes. Gas-heated, complete with Broom and Wade compressor with motor, starter and main and balancing tanks, complete with 4 master moulds, £500 the lot. Courtenay, Ltd., 138 Stratford Road, Birmingham, 11. 172-x7251

FOR SALE. One "Manesty" No. 2 tablet compressing machine. First-class mechanical condition. Fully motorized. Necessary spares with machine. £150 net works. Inpection invited. Adams and Sons, Engineers, West Street, Harrow, Middlesex. Byron 1921. 172-5

MACHINERY, TOOLS AND PLANT WANTED

ADVERTISER wishes to purchase complete plastic moulding plant with injection moulding machines from 2 oz. to 6 oz. approximately, London District preferred. Willing to take over lease if necessary. All replies treated with strictest confidence. Reply Box P7211, care of "Plastics." 172-35

WANTED. Several Reed Prentice injection moulding machines, capacity 8 oz., 12 oz. and 16 oz. Box P7217, care of "Plastics." 172-26

WANTED, one 500-ton upstroke press, one to three daylights, minimum size of steam-heated platen 7 ft. by 2 ft., minimum stroke 18 ins. with pump unit, electrical current 400v, three-phase, 50 cycles. Details to Oakley Rubber, Ltd., Lichfield Road, Brownhills, Staffs. 172-6

REQUIRED, second-hand sprue and waste cutter. Gordon, 219 Hamstel Road, Southend-on-Sea. 172-7

WANTED, down stroking hydraulic moulding presses fitted with pre-filler and push-back rams, 75 to 240 tons, suitable for 1-ton line working. W. T. Henley's Telegraph Works Co., Ltd., Engineering Department, Gravesend, Kent. 173-2681

PRODUCTION CAPACITY AVAILABLE AND WANTED

FAIRMAN PRECISION TOOLS AND PRODUCTS, LTD., of Horley, Surrey, have capacity for the manufacture of Bakelite and plastic moulds, die-casting, dies, press tools and special-purpose machines. Also all classes production machining. Phone, Horley 909. 172-2042

INJECTION MOULDING CAPACITY available up to 4 oz. Precision moulding a speciality. Guardian Plastics, 345 Kennington Road, London, S.E.11. 173-2082

REPETITION in Ebonite, Erinoid, etc. Capstan lathe work. Mansell, Temple Street, Rugby. 173-2080

INJECTION MOULDING by I.O.G. Industries, Ltd., 41 Marshgate Lane, Stratford, E.15. Maryland 2804. 172-2259

PLASTICS (MANCHESTER), LTD.,
Britain's Leading Stockists,
SPECIALISTS IN
FABRICATION, INJECTION,
MOULDING AND ENGRAVING.
11 WHITWORTH STREET, MANCHESTER, 1.
CENTRAL 0272-1725. zzz-308

COMPRESSION AND INJECTION MOULDINGS, capacity available, reasonable delivery, competitive prices. Box P644, care of "Plastics." 175-2618

MOULDING CAPACITY available up to 3 ozs. injection and 50 tons compression. Small electrical medical equipment mouldings our speciality. Solsway Plastic Laboratories, Ltd., Lancaster Road, High Wycombe. Phone, High Wycombe 2136. 175-2613

SHORT RUNS A SPECIALITY. Long runs a pleasure. Low mould costs and overheads on our Westminster injection machines. Westminster Plastics, 367 High Street, North, Manor Park, London, E.12. Grangewood 3777. 175-2611

DOHM, LTD., pulverizing raw materials everywhere. We have 12 factories. 167 Victoria Street, London, S.W.1. zzz-309

INJECTION MOULDINGS IN POLYSTYRENE AND ACETATE, ETC. Capacity available on modern mass production plant up to 8 oz. Can use your moulds or produce moulds in our first-class toolroom. We have extensive and long experience in production of industrial, fancy goods and toys. Plasticast Developments, Ltd., Princes Street, Peterborough. 183-2679

Production Capacity Available and Wanted (contd.)

PLASTICS (MANCHESTER), LTD
BRITAIN'S LEADING STOCKISTS AND DISTRIBUTORS.
SPECIALISTS IN
FABRICATION, INJECTION MOULDING AND ENGRAVING.
11 WHITWORTH STREET,
MANCHESTER, 1.
Central 0272, 1725, 1000.
zzz-316

KINGSTON PLASTICS, LTD., Unity Works, Union Street, Kingston-on-Thames. Manufacturers of virgin and second grade cellulose acetate moulding powders, matched to customer's own requirements for colour and flow. Customer's own waste also reprocessed to specified requirements. Sorting and grinding, incorporating magnetic separation of metallic particles, of all thermo-plastics undertaken. Phone, Kingston 8405. zzz-315

ASSEMBLY OR ANY TYPE light hand repetition work wanted by small Surrey firm. Female labour. Box P7228, care of "Plastics." 173-x7142

INJECTION MOULDING CAPACITY shortly available up to 4 oz., precision work a speciality. Box P7231, care of "Plastics." 172-x6562

SMALL ACRYLIC MOULDINGS, difficult shapes, short runs, etc. High quality, excellent service to manufacturers. Write Box P7229, care of "Plastics." 172-x7202

INJECTION MOULDINGS IN THERMOPLASTICS. Mouldings in styrene, acrylics and acetate. Design and toolroom facilities available for mould construction. Inquiries invited. J. and E. Courtenay, Ltd., 138 Stratford Road, Birmingham, 11. 173-x6121

RAW MATERIAL AVAILABLE AND WANTED

WASTEPAPER WANTED. Regular collections arranged. Your office records confidentially destroyed. Thermoplastic scrap also collected. Dribbell, Phone, Battersea 3301. 174-2593

THERMO-PLASTIC SCRAP AND MOULDING POWDERS of all types wanted. We collect and pay cash. Box P614, care of "Plastics." zzz-287

WASHED ACETATE X-RAY SHEET, sizes 8½ ins. by 6½ ins. to 15 ins. by 12 ins., and parcels mixed sizes. Celastoid sheet, 27 ins. by 24 ins. by .015 in., in pink, green, blue. Mixed acetate and nitrate rolls, 5 ins. by approximately 24 ft., with light imprint similar in sheet, approximately 24 ins. by 20 ins. by .003 in. Lists and samples from Lloyd's, 2 High Street, Christchurch, Hants. Phone, Christchurch 504. zzz-302

THERMOPLASTICS Perspex sheets and scrap moulding powder wanted. We collect and pay cash. Box P6310, care of "Plastics." 174-2162

WANTED: Perspex and PVC scrap, large quantities only. Box P6311, care of "Plastics." 174-2163

ACETATE SHEET, 20, 30 and 40 thou. clear for disposal. Roll "Clarifoil" 39-in. wide 3 thou., 140 lb. new. Wanted, Perspex ⅛-in. 461 and 491 to complete work. Bly, 370 Upper Street, London, N.1. Can 3425. 175-2594

ALL THERMOPLASTIC SCRAP wanted. Sell to the manufacturers who can pay best prices—promptly. Collection from your works if required. Samples and details to Almex, Ltd., Imperial Works, Watery Lane, Birmingham, 9. Phone, Vic 0238 and 0329; or 120 Moorgate, London, E.C.2. Phone, Met 9641. 172-2258

WANTED, job lots of plastic sheeting and leathercloth. Samples and price lists in duplicate to Box P.P.35193, Samson Clarks, 57-61 Mortimer Street, London, W.1. 172-1

CATALIN RODS. Approximately one ton ivory 35 mm. at 25% below list price. Marberry Products, Ltd., Hurstpierpoint, Sussex. 172-4

POLYSTYRENE CLEAR SHEET and rods and foil for sale. Sheets 16 by 24 by ½-in. to 1⅝ in. thick. Rods ⅝-in. to 1½-in. diam., 24 ins. long. Foil 13/16-in. wide by ¾-mils. thick, in coils, about 2 tons in all, but small quantities supplied.
John Castle and Co., Ltd., 5 Hurley Road, Kennington, S.E.11. Phone, Rel 4274 172-8

CATALIN RODS. Large quantity for sale, 7/16-in. diameter, 21 ins. long in translucent amber, red, blue; also tortoiseshell, honey mottle and black at 25% under list prices. John Castle and Co., Ltd., 5 Hurley Road, Kennington, London, S.E.11. Reliance 4274. 172-9

WANTED TO PURCHASE FOR CASH. "CELLOPHANE" CELLULOSE FILM SHEET or rolls, 300, 400 and 600 SUB. Send samples with full details and prices. Alans, 37 Farringdon Street, E.C.4. Phone, Cen 5947. 172-12

BLACK PHENOL MOULDING POWDER wanted, any grade, any quantity. Box P686, care of "Plastics." 173-2680

NYLON MOULDING POWDER wanted by direct users. Uncoloured natural virgin or scrap. Top prices paid. Write, N.M.P., care of Dixons, 1-9 Hills Place, Oxford Street, W.1. zzz-313

PERSPEX! PERSPEX!! PERSPEX!!! Official stockists for I.C.I. acrylic sheets. Sheets cut your requirements. Fabrication and mounting specialists to the trade:—
S. C. Errington (Hanwell), Ltd., 132a Uxbridge Road, Hanwell, London, W.7. Phone, Ealing 5288. zzz-314

ERLANDOS, LTD., 93 Aldersgate Street, E.C.1 (Monarch 4686), require Perspex and cellulose acetate offcut and scrap, clear and coloured, highest prices paid. 173-2524

PHENOLIC AND CRESOLIC MOULDING POWDERS in many grades and colours regularly available. Chart Edge, Ltd., 44-45 Pall Mall, S.W.1. Phone, Whitehall 9137. 172-31

CLEAR CELLULOSE ACETATE TUBING for all pen refills. Lacto'd and erinoid rods in mottled, silks and plain colours. Ebonite rods, tubes and sheet. Prompt deliveries assured from A. E. Goodeve, Ltd., 188a Seven Sisters Road, London, N.7. Archway 3654. 175-2261

Always large stocks of
CASEIN
rods, tubes and sheets.
PERSPEX
sheets up to 1-in. thick.
CELLULOSE ACETATE.
S. Rosenfield,
98 Aldersgate Street, E.C.1.
Phone, Monarch 4686. 174-2592

4½ TONS BUFF VIRGIN DIAKON MOULDING POWDER for sale. Apply Box P5725, care of "Plastics." zzz-306

POLYSTYRENE SHEETS AND ROD. Sheets 28 ins. by 20 ins. and 22 ins. by 18 ins. Rod, various diameters in 6-ft. lengths. Also Acrylic rod in various diameters. Miltoid, Ltd., 34-36 Royal College Street, Camden Town, N.W.1. Phone, Euston 6467. 172-2621

LUSTRON MOULDING POWDERS required in substantial quantities. Prompt or forward delivery. Full details to Box P706, care of "Plastics." 172-2624

CHEMICALS, PIGMENTS, METAL, POWDERS, we control 12 factories. Dohm, Ltd., 167 Victoria Street, S.W.1. zzz-310

"DELAFILA," THE INERT FILLER. The original slate powder. Ten degrees of fineness. Uniform particle shade. Inert. Light in colour. Prompt deliveries. A product of The Old Delabole Slate Co., Ltd., Delabole, Cornwall. 173-312

Raw Material Available and Wanted (contd.)

BAKELITE LAMINATED S.R.B.P. AND S.R.B.F. SHEETS required in good condition. Write, Box P7121, care of "Plastics." 176-2645

PAPER-FILLED and wood-filled Urea moulding materials wanted urgently. Please state colour, price and quantity available. Box P719, care of "Plastics." 172-2642

PERSPEX. Quantity of sheets, various colours and thicknesses; also made-up articles. Phone, Hindhead 123. 172-x7205

FOR SALE. Perspex Pink 425, 200 sheets 48 ins. by 48 ins. by ⅛ in., paper covered. Offers considered. Box P7227, care of "Plastics." 172-51

REQUIRED URGENTLY small or large quantities of ethyl cellulose, cellulose acetate butyrate (Tenite II), cellulose propionate—virgin or scrap—unpigmented only. Box P684, care of "Plastics." 172-50

PERSPEX ACRYLIC SHEETS from 1/16th in. to ½ in. thickness. Clear and coloured. J. H. Berry (Plastics), Annesley Woodhouse, Notts. 172-49

CUEX, LTD., can offer all at prices well below current list:—
Polystyrene.
Cellulose Acetate.
Polyethylene.
P.V.C.
Polyvinal Dutyral.
Perspex and Diakon.
Send now for details.
Cuex, Ltd. 270 Corporation Street, Birmingham Central 5474. 172-46

UREA FORMALDEHYDE MOULDING POWDER. Surplus to requirements. Up to 10 cwt. each in ivory and red. Offers. J. H. Berry (Plastics), Portland Works, Annesley Woodhouse, Notts. 172-47

P.V.C. SHEETING OFFCUTS, high-grade material, colour sorted, continuously available. Inquire with Chart Edge, Ltd., 44-45 Pall Mall, S.W.1. Phone, Whitehall 9137. 172-32

CATALIN. Large stocks, large variety of sections and colours, immediate delivery. J. H. Berry (Plastics), Annesley Woodhouse, Notts. Phone, East Kirkby 2151. 172-48

BLACK REPROCESSED CELLULOSE ACETATE MOULDING POWDER, 5 tons for disposal. Box P7220, care of "Plastics." 172-21

SIX TONS OF BROWN P.V.C. COMPOUND available for prompt delivery. Box P7225, care of "Plastics." 172-15

P.V.C. SCRAP, preferably black tubing, in large quantities for export required. Please offer, with samples, to Herbert Connor, 120 Beaufort Park, Falloden Way, London, N.W.11. 172-16

POLYSTYRENE, new Monsanto, approximately 1½ tons, transparent green, below works price as surplus for sale. Box P7223, care of "Plastics." 172-24

PARAFORMALDEHYDE. Monthly allocation of 1-2 tons British material available. Write, Box P7219, care of "Plastics." 172-25

P.V.C. SHEETING OFFCUTS (unbacked handbag material), regular supplies available. Box P7214, care of "Plastics." 172-30

APPROXIMATELY 30-CWT. BLACK UREA FORMALDEHYDE MOULDING POWDER. Apply Box P729, care of "Plastics." 172-36

POLYSTYRENE SCRAP in quantites wanted. Please send details with price and samples to Herbert Connor, 120 Beaufort Park, Falloden Way, London, N.W.11. 172-18

GOOD QUANTITIES of polystyrene and C.A. powders at competitive prices. Box P728, care of "Plastics." 172-37

MANUFACTURER requires regularly quantities of clear Perspex ⅛-in., 3/16-in. and ¼-in. in sheets but offcuts may be acceptable. Please quote sizes details and price and send offers to Box P7210, care of "Plastics." 174-2684

POLYTHENE SCRAP, ground and virgin, surplus lots urgently wanted. Please offer with samples to: Herbert Connor, 120 Beaufort Park, Falloden Way, London, N.W.11. 172-19

CELLULOID SHEETS 10/1,000-in., approximately 1,000 lb. each of pastel blue, pink and green for sale. Please apply Box P7222, care of "Plastics." 172-23

CELLULOSE ACETATE MOULDING POWDER, virgin, transparent and opaque, below works price, ground acetate, butyrate and diakon for sale. Herbert Connor, 120 Beaufort Park, Falloden Way, London, N.W.11. 172-20

REPROCESSED POLYSTYRENE in various colours continuously for sale. Inquiries invited. Herbert Connor, 120 Beaufort Park, Falloden Way, London, N.W.11. 172-17

ALKATHENE, virgin and reground, in quantities required. Box P7221, care of "Plastics." 172-22

LARGE PERSPEX OFFCUTS for sale, green 621, blue 721, cream 120; 330 pieces 30-in. by 10-in. Davis, 26 Chapel Street, N.W.1. Amb 3689. 172-x6362

SITUATIONS VACANT

PLASTICS. Complete, inexpensive tuition at low inclusive fees. For free details, write to The Principal, The Rapid Results College of Engineering Technology, Dept. E.152, Tuition House, London, S.W.19 (or call at 235 Grand Buildings, Trafalgar Square, W.C.2). Whitehall 8877. zzz-300

PLASTIC MOULDING. Working foreman required near London. Must have full knowledge of compressing and injection moulding technique. Able to control and train raw labour. Excellent opportunity for man with initiative and drive. Good salary. Please state past experience and salary required. Box P705, care of "Plastics." 172-2625

PLASTIC PRODUCTION CHEMIST wanted for extruding thermoplastic powders; London area. Please apply Dohm, Ltd., 167 Victoria Street, S.W.1. 172-2640

A VACANCY EXISTS for a personal assistant to the head buyer of a well-known plastics and rubber manufacturing company in North-West England. Applicants should be around 30 years of age and have had previous experience, preferably in a similar industry. For the right man the prospects of advancement are excellent. Applicants should give full details of positions held and state present remuneration. Box P7118, care of "Plastics." 172-2643

PLASTIC MOULD DESIGN DRAUGHTSMEN required with experience in compression transfer and injection tool construction. Only keen men willing to use initiative who can command a salary of £600-£700 per annum need reply. London area. Give full details of age and qualifications to Box P7016, care of "Plastics." 172-10

TECHNICAL SALES REPRESENTATIVE required for London Office. Application, stating qualifications, experience and salary required, to be forwarded to Universal Metal Products, Ltd., Langley Road, Salford, 6. 172-3

EXPERIENCED FOREMAN required to take charge of injection moulding department at U.M.P. Southport factory. Apply to Universal Metal Products, Ltd., Langley Road, Salford, 6. 172-2

TOOL DESIGNER with considerable experience of injection moulding work required by large company in North Midlands. High salary and excellent prospects for right man. Full details to Box P7218, care of "Plastics." 172-27

DRAUGHTSMAN, senior, plastic mould designer, required for West of Scotland. Must be capable of working on own initiative. Experience with compression, transfer and injection moulding, also laminated moulding. Salary commensurate with experience and ability. Replies, which will be treated in confidence, should give full details of experience and qualifications, together with salary required. Box P7216, care of "Plastics." 172-28

LARGE MANUFACTURERS OF CELLULOSE ACETATE MOULDING POWDER in the Midlands require thoroughly experienced representative with full knowledge of the trade and consumers. Good salary and commission for the right man. Box P7226, care of "Plastics." 172-14

DESIGNER DRAUGHTSMAN with wide experience of injection and compression moulds required to take charge of small drawing office, South Essex area. Please reply to Box P722, care of "Plastics," stating age, experience and salary required. 173-2685

Situations Vacant (contd.)

MANUFACTURERS OF NEW PRODUCTS in an expanding branch of the rubber and plastics industry invite applications for the position of development chemist, to promote the utilization of high polymers and to develop modern production methods. The position offers good prospects to progressive, practical, energetic and experienced technician. Please write, in confidence, stating age, education, experience and salary required, to Works Manager, Semtex, Ltd., Fort Dunlop, Erdington, 24. 173-2686

SENIOR MOULD DESIGN DRAUGHTSMAN required with wide experience in injection moulding tool construction in London area. Highest salary offered to artistically minded man with initiative and keen interest in his work. Give full particulars of age and qualifications to Box P7212, care of "Plastics." 172-34

FOREMAN for night shift of the injection moulding department of company in N.W. London area. Please reply Box P725, care of "Plastics." 172-39

FOREMAN to take charge of injection moulding machine shop of company situated in N.W. London area. Previous experience in similar capacity coupled with sound production knowledge is essential. Please reply Box P726, care of "Plastics." 172-40

ENGINEER required by company manufacturing plastic sheathed wires and cables and profiled extrusions. Must be fully conversant with extrusion machinery, design and development of tools, dies and ancillary equipment, and able to advise on all technical problems. May be required to take charge of maintenance department. London area. Please reply with full details to Box P724, care of "Plastics." 172-41

MOULDING SHOP SUPERINTENDENT (Plastic) required Bradford area. Must be fully experienced in all forms of moulding and be capable of controlling production and labour. Only experienced men need apply. Write, stating full qualifications, etc., to Box P7215, care of "Plastics." 172-29

Situations Vacant (contd.)

MANUFACTURERS OF NEW PRODUCTS in an expanding branch of the rubber and plastic industry invite applications for the position of development chemist to promote the utilization of high polymers and to develop modern production methods. The position offers good prospects to progressive, practical, energetic and experienced technician. Please write in confidence stating age, education, experience and salary required to the Works Manager, Semtex, Ltd., Fort Dunlop, Erdington, Birmingham, 24. 172-52

SITUATIONS WANTED

WORKS MANAGER, experienced moulding technician, desires position offering scope and possibilities. Box P7230, care of "Plastics." 172-x6879

TIME RECORDERS

FACTORY TIME RECORDERS. Service rental. Phone, Hop 2239. Time Recorder Supply and Maintenance Co., Ltd., 157-159 Borough High Street, S.E.1. 73-2081

MISCELLANEOUS

EXTEND YOUR TRADE.
Use a Trade Mark. Consult
Trade Mark Protection Society,
12 Church Street, Liverpool. 178-2451

SURPLUS OR REDUNDANT STOCKS will be purchased for cash. Any quantity considered. Send full details to Lawrence Edwards and Co., 23-25 Kensington Park Road, London, W.11. Phone, Bayswater 4020. 172-2620

CARTONS, new and once used, large quantities available. Gerrard Trading Co., 21 Bateman Street, London, W.1. Gerrard 1123. 175-2619

STAFF TIME CHECKING and job costing time recorders, all makes for quick cash sale, exceptional condition. Write Box 669, Smiths, 100 Fleet Street, E.C.4. 172-11

WANTED
STOCKS FOR CASH

WE are cash buyers of merchandise of every description. Also Clearance Stocks, Discontinued Lines, Surplus Stocks; in fact, goods of all kinds can be disposed of through us, without delay, on the most favourable terms, and without trouble.

SHOULD you have anything for disposal, either now or at any future time, please send us samples, full particulars and price on a cash settlement basis.

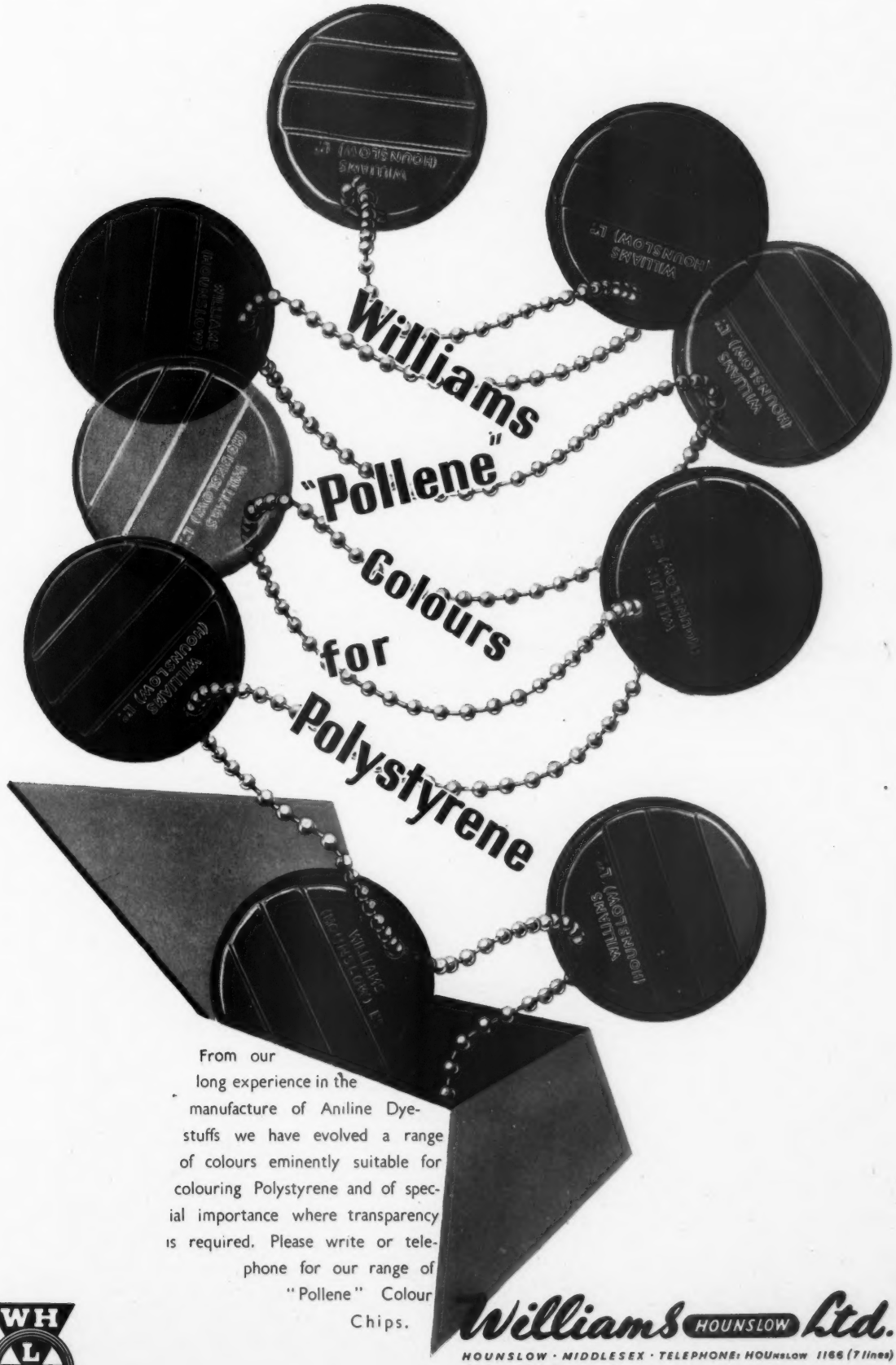
RELIANCE TRADING COMPANY
13, New College Parade, Finchley Road, London, N.W.3
TELEPHONE: PRIMROSE 3167 AND 5611

FIRE!
WHERE'S YOUR
NU-SWIFT?
The World's Fastest Fire Extinguishers
— for every Fire Risk
Pressure-operated by sealed CO_2 Charges
NU-SWIFT LTD. • ELLAND • YORKS
In Every Ship of the Royal Navy

INDEX TO ADVERTISERS

Name	Page
A	
Alfa Plastics, Ltd.	57
Ashdowns, Ltd.	10
Axon & Harrison, Ltd	59
B	
Bakelite, Ltd.	34
Bakelite, Ltd. (Vybak)	Back Cover
Baldwin Instrument Co., Ltd., The	55
Barber & Duffy, Ltd.	62
B.I.P. Tools, Ltd.	3
Birkby's, Ltd	21
Birmingham Pressure (E. Hartland) Die-casting, The	61
Bradley & Turton, Ltd.	58
Bridge, David, & Co., Ltd.	39
British Electrical Development Association	41
British Ermeto Corporation, Ltd.	50
British Industrial Plastics, Ltd.	40
British Moulded Plastics, Ltd.	36
British Resin Products, Ltd.	5
BX Plastics, Ltd.	23
Byson Appliance Co., Ltd.	62
C	
Calderon, M., Ltd.	61
Carpenter, J. H., & Son, London, Ltd.	60
Carter Gears, Ltd.	56
Chamberlain & Willows	62
Chase, Bernard	14
Cohen, George, Sons & Co., Ltd.	58 & 61
Coldwell, W. B., & Sons, Ltd.	58
Cole, E. K., Ltd.	29
Cole, R. H., & Co., Ltd.	33
Commercial Plastics, Ltd.	26
Crystalate, Ltd.	12
D	
Davis Bros. (Metal & Plastics) Ltd.	63
Davis & Timmins, Ltd.	59
Dohm, Ltd.	60
Duratube & Wire, Ltd.	1
E	
East Anglia Plastics, Ltd.	20
English Steel Corporation, Ltd.	16
Erinoid, Ltd.	Inside Front Cover
Ether, Ltd.	52
Evans, Frederick W., Ltd.	60
F	
Ferguson, James, & Sons, Ltd.	45
Finney Presses, Ltd.	48
Firth Brown Tools, Ltd.	43
Flexigrip, Ltd.	32
Flextol Engineering Co. Ltd.	52
Funditor Ltd.	56
G	
Gales, Gilbert	60
Gardner, Wm., & Sons, (Glos.) Ltd.	57
Gas Council, The	4
Gayler & Hall, Ltd.	59
General Electric Co. Ltd., The	22
Guest, Keen & Nettlefolds (Midlands) Ltd.	44
H	
Harris, Alfred, & Co. (Richmond) Ltd.	48
Hupfield Brothers, Ltd.	28
I	
Imperial Chemical Industries, Ltd.	37
Industrial Plastics, Ltd.	57
Injection Moulders, Ltd.	7
J	
Johnson, Matthey & Co., Ltd.	38
K	
Kent Mouldings	54
Kenure, J. F., Ltd.	63
Kodak, Ltd.	51
L	
London & Scandinavian Metallurgical Co., Ltd.	63
M	
Marshall, C. & C., Ltd.	63
Martin, T. G., & Co.	55
May & Baker, Ltd.	9
Micanite & Insulators Co., Ltd., The	Front Cover
Monsanto Chemicals, Ltd.	24 & 25
N	
Nu-Swift, Ltd.	66
P	
Page, Chas., & Co., Ltd.	61
P. A. M., Ltd.	50
Perkins & Seward, Ltd.	62
Pignon Plastics, Ltd.	53
Pitman, Sir Isaac, & Sons, Ltd.	62
Plastic Engineers, Ltd.	49
Plastomatic, Ltd.	8
Polythene, Ltd.	56
Projectile & Engineering Co., Ltd., The	18 & 19
R	
Radio Heaters, Ltd.	58
Redifon, Ltd.	53
Reliance Trading Company	66
Resinous Chemicals, Ltd.	2
Rootes Mouldings, Ltd.	27
Rosedale Associated Manufacturers, Ltd.	47
Rubber Improvement, Ltd.	42
Rue, Thomas De La., & Co., Ltd.	17
S	
Shaw, Francis, & Co., Ltd.	46
Stadium, Ltd.	59
Steele & Cowlishaw, Ltd.	52
Stevens, Michael S.	62
Sundstrand Sanders, Ltd.	30
T	
Tant, W. H., & Co., Ltd.	49
Thermo-Plastics, Ltd.	13
Thompson & Norris Mnfg. Co., Ltd., The	55
Toolchrome, Ltd.	54
Turner Bros. Asbestos Co., Ltd.	51
Turner Manufacturing Co., Ltd.	6
Tyne Truck & Trolley Co., Ltd.	54
U	
United Ebonite & Lorival, Ltd.	31
Universal Tools, Ltd.	42
Utilex, Ltd.	44
V	
Vinyl Products, Ltd.	15
W	
Wiggins Teape & Alex Pirie (Sales) Ltd.	11
Williams (Hounslow) Ltd.	Inside Back Cover

Printed in England and Published Monthly by the Proprietors, TEMPLE PRESS LTD., BOWLING GREEN LANE, LONDON, E.C.1.
Annual subscription rate 34/- (Canada and U.S.A. $5.50). Shorter periods pro rata. Registered for transmission to Canada and Newfoundland by magazine post. AGENTS ABROAD—EUROPE—Messageries Dawson (S.A.), Paris; Messageries Hachette et Cie, Paris; W. H. Smith & Son, Paris and Brussels. U.S.A.—International News Co., New York. CANADA—Wm. Dawson Subscription Service Ltd., Toronto; Gordon & Gotch, Ltd., Toronto. AFRICA—Central News Agency, Ltd., Cape Town; W. Dawson & Son (S.A.), Cape Town. ASIA—W. Thacker & Co., Ltd., P.O. 190, Bombay. AUSTRALIA and NEW ZEALAND—Gordon & Gotch (A'sia) Ltd.



From our long experience in the manufacture of Aniline Dyestuffs we have evolved a range of colours eminently suitable for colouring Polystyrene and of special importance where transparency is required. Please write or telephone for our range of "Pollene" Colour Chips.

WHL

Williams (HOUNSLOW) Ltd.

HOUNSLOW · MIDDLESEX · TELEPHONE: HOUNSLOW 1166 (7 lines)

MANUFACTURERS OF ANILINE DYESTUFFS SINCE 1877

NOVEMBER, 1951 Plastics TWO SHILLINGS & SIXPENCE

For toys to stand rough treatment
or smocks to stand up to acids,
for covering cables and clothes lines,
for gaskets and garden hose,
bottle caps, belts and book jackets,
switch covers, set squares and slide rules . . .
As mouldings, extrusions and sheet—
rigid and flexible, coloured or clear . . .
In a host of ways VYBAK Plastics show their versatility.

VYBAK
REGD. TRADE MARK
PLASTICS

A PRODUCT OF BAKELITE LIMITED · 18 GROSVENOR GARDENS · LONDON · SW1